

XEROX

Xerox University Microfilms

Ann Arbor, Michigan 48106

WESTERN AMERICANA

Reproduced from the original in the collection of
THE HENRY E. HUNTINGTON LIBRARY AND ART GALLERY

DEEP-WATER HARBOR AT PORT LOS ANGELES
OR AT SAN PEDRO, CAL.

LETTER

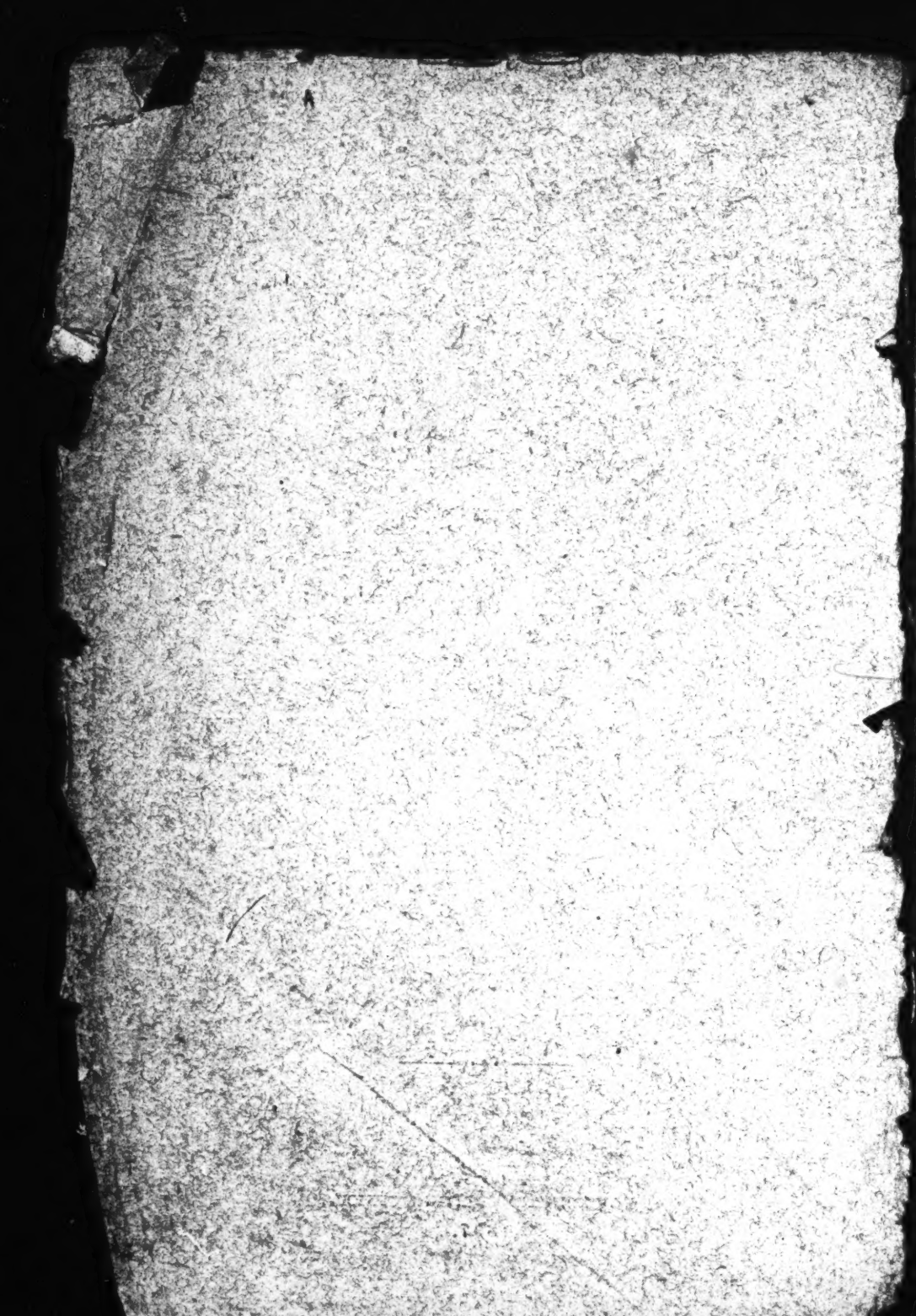
OF THE

SECRETARY OF WAR,

IN RESPONSE TO

THE RESOLUTION OF THE SENATE DATED MARCH 3, 1897, DIRECTING HIM "TO TRANSMIT TO THE SENATE THE REPORT MADE TO HIM BY THE BOARD APPOINTED TO LOCATE A DEEP-WATER HARBOR FOR COMMERCE AND OF REFUGE AT PORT LOS ANGELES OR AT SAN PEDRO, CAL., UNDER THE PROVISIONS OF THE RIVER AND HARBOR ACT OF JUNE 3, 1896, TOGETHER WITH THE PLANS, SPECIFICATIONS, AND ESTIMATES MADE BY SAID BOARD," TOGETHER WITH ACCOMPANYING MAPS AND PAPERS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.



150

55TH CONGRESS, }
1st Session. }

SENATE.

{ DOCUMENT
No. 18.

DEEP-WATER HARBOR AT PORT LOS ANGELES OR AT SAN PEDRO, CAL.

APRIL 1, 1897.—Referred to the Committee on Commerce and ordered to be printed.

The VICE-PRESIDENT presented the following

LETTER OF THE SECRETARY OF WAR, IN RESPONSE TO THE RESOLUTION OF THE SENATE DATED MARCH 3, 1897, DIRECTING HIM "TO TRANSMIT TO THE SENATE THE REPORT MADE TO HIM BY THE BOARD APPOINTED TO LOCATE A DEEP-WATER HARBOR FOR COMMERCE AND OF REFUGE AT PORT LOS ANGELES OR AT SAN PEDRO, CAL., UNDER THE PROVISIONS OF THE RIVER AND HARBOR ACT OF JUNE 3, 1896, TOGETHER WITH THE PLANS, SPECIFICATIONS, AND ESTIMATES MADE BY SAID BOARD," TOGETHER WITH ACCOMPANYING MAPS AND PAPERS.

REPORT OF BOARD.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, D. C., March 30, 1897.

SIR: In response to the resolution of the Senate dated March 3, 1897, directing the Secretary of War "to transmit to the Senate the report made to him by the Board appointed to locate a deep-water harbor for commerce and of refuge at Port Los Angeles or at San Pedro, California, under the provisions of the river and harbor act of June 3rd, 1896, together with the plans, specifications, and estimates made by said Board," I have the honor to transmit:

1. The report of the Board dated March 1, 1897, with two appendixes and three tracings which accompanied it, and letter of the chairman of the Board transmitting the same, in which it is stated that other appendixes and drawings would be submitted later.
2. Letter of the chairman of the Board dated March 15, 1897, transmitting a minority report signed by Mr. Richard P. Morgan.

3. Letter of the chairman of the Board dated March 18, 1897, transmitting additional appendixes and maps to accompany the report of the Board dated March 1, 1897.

Very respectfully,

R. A. ALGER,
Secretary of War.

The PRESIDENT, UNITED STATES SENATE.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 8, 1897.

SIR: I have the honor to acknowledge receipt of the resolution of the Senate of the United States of March 3, 1897, directing the Secretary of War "to transmit to the Senate the report made to him by the Board appointed to locate a deep-water harbor for commerce and of refuge at Port Los Angeles or at San Pedro, California, under the provisions of the river and harbor act of June 3rd, 1896, together with the plans, specifications, and estimates made by said Board," and in answer to its reference to this office for report, I have to submit the accompanying copy of report called for, dated March 1, 1897.

The report of the Board is accompanied by two appendixes, (A) specifications for breakwater, and (B) estimate of cost of breakwater, and by three tracings.

The report was intended to be accompanied by other appendixes and two additional drawings, but the absence of these is explained by Admiral Walker in his letter of March 1, herewith.

The resolution¹ of the Senate is herewith returned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

LETTER OF CHAIRMAN OF BOARD.

BOARD FOR LOCATING A DEEP-WATER HARBOR
IN SOUTHERN CALIFORNIA,
Washington, D. C., March 1, 1897.

SIR: The Board for locating a deep-water harbor in southern California herewith transmits to you its final report. This report is signed by four members of the Board.

The first two appendixes, which cover the work which the Board is required by law to do, are attached to this report. The other five appendixes, which are simply a part of the record, will be transmitted as soon as they can be put in neat and proper form.

Three sheets of drawings accompany this report, while two others will be transmitted as soon as they can be properly reproduced.

The fifth member of the Board desires further time before deciding

¹ Not printed.

whether to sign the majority report now submitted or to prepare a minority report.

Very respectfully,

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

The SECRETARY OF WAR.

REPORT OF BOARD.

WASHINGTON, D. C., *March 1, 1897.*

SIR: The Board appointed under the provisions of the river and harbor act of June 3, 1896, to locate a deep-water harbor in southern California, has the honor to submit the following report:

The law provides as follows:

For a deep-water harbor for commerce and of refuge at Port Los Angeles, in Santa Monica Bay, California, or at San Pedro, in said State, the location of said harbor to be determined by an officer of the Navy, to be detailed by the Secretary of the Navy, an officer of the Coast and Geodetic Survey, to be detailed by the Superintendent of said Survey, and three experienced civil engineers, skilled in riparian work, to be appointed by the President, who shall constitute a Board and who shall personally examine said harbors, the decision of a majority of which shall be final as to the location of said harbor. It shall be the duty of said Board to make plans, specifications, and estimates for said improvement.

The Board convened at Washington, D. C., on November 16, 1896, and organized by electing Rear-Admiral John G. Walker, U. S. N., chairman; it then proceeded to the examination of such data bearing upon its duties as could be found in Washington. Further meetings were held in Washington on November 17 and 18, and on the latter date the Board adjourned to meet in Los Angeles, Cal., on December 9, but it being found impracticable to meet on that date, the meeting was postponed until December 16. The city of Los Angeles was made the headquarters of the Board during its stay in California. Between the dates of December 21 and 30, both inclusive, public hearings were held by the Board on seven days, at which all parties in interest were afforded full opportunity to present testimony and argument bearing upon the merits of the two locations. A complete report of these hearings is appended to this report, and marked Appendix F. In addition to these public hearings, the Board held frequent meetings during its stay at Los Angeles, and repeatedly visited and examined the two locations during such conditions of weather as prevailed while the Board remained in California. Careful hydrographic surveys for purposes of verification were made at both the locations named in the law, and in addition, full sets of jet borings were made along the lines of the proposed breakwaters, along the channel leaning into the inner harbor at San Pedro, and at such other points as were deemed advisable.

The charts and sections exhibiting the complete results of these surveys and examinations are appended to this report. The Board also visited and examined such other points on the coast of southern California as in the judgment of its members would afford information of value in the selection of the site. The Board also visited a number of quarry sites in that part of California, both on the mainland and on the island of Santa Catalina, in order to confirm the existence of rock of suitable quality for the construction of the breakwater and to secure the data requisite for making the necessary estimates. On January 23, 1897, the Board adjourned to meet in Washington on February 10, since

which time frequent meetings have been held for the purpose of examination and consideration of the data obtained and for the preparation of this report.

The act under which this Board is appointed provides for a deep-water harbor for commerce and of refuge. Under the provisions of the law a deep-water harbor is understood to be a harbor which can be used by vessels of the deepest draft. Merchant vessels drawing from 26 to 28 feet are now common, while steamers have been built which when fully loaded will draw 30 feet, or even more. The deepest draft of any vessel in the United States Navy exceeds 27 feet, while some foreign naval vessels draw fully 32 feet. In view of these facts, it would seem that a deep-water harbor must be one which will safely accommodate vessels drawing at least 30 feet.

The provision that it shall be a harbor for commerce is understood to mean that it shall be a harbor in which vessels can load and discharge cargoes in convenient proximity to suitable facilities for storage and for interchange between land and water transportation. In many ports of the world this work is done by the aid of lighters while the ships lie at anchor, a slow and expensive method, which can no longer be considered satisfactory. A deep-water harbor for commerce should be such that the deepest ships can come alongside quays or piers where they can lie quietly during rough weather to receive and discharge their cargoes, and where proper facilities for docking and repairs may be afforded.

The provision that it shall be a harbor of refuge is understood to mean that it shall be a harbor which all classes of vessels can enter in stress of weather, without waiting for tides, and where they can anchor in safety at all times. The depth of water in the proposed harbor of refuge must be such that the largest ships can safely ride at anchor within its limits, swinging over their own anchors without danger.

One of the two locations specified in the act is "at Port Los Angeles, in Santa Monica Bay." Santa Monica Bay embraces the area between Point Dume and Rocky Point. Port Los Angeles is the name given by the Southern Pacific Company to its station on the wharf which it has constructed about 2 miles west of Santa Monica Village; on the Coast Survey charts this name is applied to a point on the shore at the mouth of the Santa Monica Canyon; there is at present no post-office, municipality, or other legal incorporation bearing this name. In the absence of any further description, Port Los Angeles must be understood to mean the Southern Pacific Company's pier, and a deep-water harbor at Port Los Angeles must be so situated as to include this pier within its protected area.

The other location specified in the act is "at San Pedro." The name San Pedro is applied to the roadstead which lies immediately east of Point Firmin, and which is called San Pedro Bay; it is also the name of a post-office, incorporated village (city of the sixth class), and railroad station lying north of Point Firmin, and near the west end of San Pedro Bay. The water area immediately east of this village, and separated from San Pedro Bay by Rattlesnake Island and the jetties which the United States Government has constructed, is designated on the Coast Survey charts as San Pedro Harbor. A shallow, landlocked lagoon inside of San Pedro Harbor was designated on the earlier Coast Survey charts as San Pedro Bay, but on the more recent ones is called Wilmington Lagoon. The village of Wilmington, on the north side of this lagoon, is the point at which freight was formerly landed, and the original terminus of the railroad from Los Angeles, which railroad was extended to its present San Pedro terminus in 1882. In the reports

of the Chief Engineers, United States Army, the whole inner basin, including the entrance, is generally referred to as Wilmington Harbor. Locally, Wilmington is understood to be the village and wharves, now dismantled, on the north side of the lagoon, while the village and wharves between the lagoon and the sea are known as San Pedro. The location at San Pedro must be understood to mean a location which will include the entrance to the inner San Pedro Harbor within its protected area.

In brief, a harbor which will fulfill the requirements of the act must be one within which wharves, basins, or docks can be constructed, and where vessels drawing as much as 30 feet can lie quietly alongside quays or piers while loading or discharging. It must furnish an anchorage, where the largest vessels can anchor in safety at all times. It must further include within its protected area either the Southern Pacific Company's pier at Port Los Angeles, or the present entrance to the inner harbor at San Pedro.

Santa Monica and San Pedro bays are open roadsteads, with exposure toward the ocean; they are separated by San Pedro Hill, which rises to a height of 1,475 feet above mean low water, and which offers to the sea a rocky face with several sharp headlands, the most easterly headland being known as Point Firmin, and the most westerly being designated on the Coast Survey charts as Rocky Point. Back of the hill lies a comparatively low and flat country which reaches from one bay to the other, the two bays being only 7 miles apart at the nearest point. This comparatively level country extends northward and eastward from the bays to beyond the city of Los Angeles, so that either bay can be easily reached from that city by railroads or other lines of communication. Although the country is comparatively flat, it rises from the sea, Los Angeles being nearly 300 feet above mean low water.

The region where these two roadsteads are located is remarkable for general equability of weather and absence of storms. During a stay of fifty days in this vicinity, in what is known as the stormy season of the year, the Board having these roadsteads under constant observation, there was not a day nor a night when an able vessel, well found in ground tackle, could not lie in entire security at anchor in either place. All evidence shows the general absence of storm winds and that dangerous gales are rare.

The heaviest seas come from the south and southwest. In San Pedro roadstead, the great ocean undulations, impelled apparently by some distant storm, are modified to some extent by the islands of San Clemente and Santa Catalina, and these islands may also somewhat modify the waves of undulation reaching Santa Monica. Notable storms are rare; they come, if at all, during the rainy season from November to March. The wind from April to October is generally from the northwest, and brings fair weather; it is sometimes boisterous, but not a storm wind. The greatest danger comes from a combination of distant ocean and local storms, producing the cumulative effects of local wind waves superimposed upon the long undulations of a great ocean swell, the source of which can be inferred, but is not seen. Such combinations occur at intervals of several years. Though rare, they must not be ignored in the construction of works designed for harbor protection.

Santa Monica Bay is the name given to the water between Point Dume and Rocky Point, the bay being about 23 miles (nautical) wide and 10 miles deep. The bay is protected from the southeast by San Pedro Hill and from the northwest by the Cahuenga Range of mountains and the shore which terminates at Point Dume. It is fully exposed

to the southwest. The village of Santa Monica is at the bottom of the bight of this bay. The Port Los Angeles pier, about 2 miles west of Santa Monica Village, is practically in the same part of the bight, but being nearer the Cahuenga Hills, is better protected from the northwest.

Santa Monica Bay is free from known submerged dangers. A deep-draft ship, entering the bay at Point Dume and coasting along its shore 1 mile distant therefrom, could round its southeastern head, Rocky Point, without having entered at any portion of her course a less depth than 40 feet at low tide. The bottom of the central portion of this bay is a plateau of easy slope, which reaches a depth of over 30 fathoms 7 miles from shore. Upon either side of this plateau much deeper water exists; on the north, the 50-fathom curve reaches within 4 miles of the shore at a point southwestward from the Port Los Angeles wharf; south of the plateau a submarine valley brings the 50-fathom curve within half a mile of the shore line at Redondo; 6 miles from shore 200 fathoms are found. A broad, sloping sand beach extends entirely around Santa Monica Bay; back of this beach, from Santa Monica to beyond the Port Los Angeles pier, a bluff of hard clay rises abruptly, this bluff opposite the pier being about 200 feet high.

About half a mile east of the pier a valley, known as Santa Monica Canyon, and containing some good arable land, opens through this bluff; a few houses are built in the mouth of this canyon. There are no tide flats and there is no opportunity for an interior basin in this part of the bay. The pier built by the Southern Pacific Company is a very thoroughly constructed timber pier, the piles being creosoted and the superstructure carefully designed. In locating this pier, care was taken to align it as nearly as possible in the direction of the approach of the heaviest swells, which was determined experimentally to be south $42^{\circ} 24'$ west, magnetic. The tracks of the Southern Pacific Railroad run to the extreme end of this pier, around which is a well-arranged system of mooring buoys, so that vessels lying at the pier can be breasted off, leaving them free to rise and fall with the swell. The pier is 4,300 feet long and terminates in $5\frac{1}{2}$ fathoms of water. It is the most carefully designed and thoroughly constructed ocean pier on the California coast. The west end of Santa Catalina Island bears south 9° east, magnetic, from the ocean end of this pier and is 32 nautical miles distant therefrom. Point Dume bears south 69° west, magnetic, from this pier, and is 13 nautical miles distant therefrom; for the intervening space, covering 78° , the pier is entirely exposed, the mean of maximum exposure being south 30° west, magnetic. Santa Catalina Island is too remote to form more than a slight protection, and the pier is really exposed over an arc reaching from Point Dume to Rocky Point, the latter bearing south 35° east, magnetic, from the end of the pier and being 18 miles distant; the exposure therefore covers 104° , the mean exposure being south 17° west, magnetic.

San Pedro Bay is of somewhat similar shape to Santa Monica Bay, but is very much smaller. Its western boundary is distinctly marked by Point Firmin, while its eastern limit is somewhat indeterminate; it is, however, practically not more than 12 miles wide and less than 5 miles deep. The heaviest undulations of the ocean, which might otherwise reach San Pedro from the southward from almost unlimited ocean distances, are first impeded in their northward progress toward the coast by the shores of San Clemente Island, approximately 20 miles south of Santa Catalina Island. This last-named island, the nearest point of which is 18 miles from San Pedro, acts as a more or less efficient barrier to storm waves generated far out to the southward. San

Pedro Bay is protected on the west by Point Firmin and San Pedro Hill. It is protected on the north and northeast by the general shore line. It has some protection on the southwest from Santa Catalina Island. It is entirely exposed to the southeast and between Santa Catalina Island and Point Firmin on the southwest. The north shore of the bay is low, and tide flats extend in places more than a mile inland. The entrance to San Pedro Harbor is an artificial channel between jetties 700 feet apart, the opening facing the southeast and being a little east of Point Firmin. A line drawn from the mouth of the jetties past Point Firmin bears south 31° west, magnetic, and strikes Santa Catalina Island near its west end. The east end of Santa Catalina Island bears south 11° east, magnetic, from the mouth of the jetties. The most southerly point on the main shore which can be considered as affording any protection whatever is San Juan Point, about 30 miles distant, and bearing south 75° east, magnetic, from the mouth of the jetties. The harbor entrance is therefore fully exposed for 64° , the mean of this exposure being south 43° east, magnetic. It is partially exposed for 42° , being the angle between the east end of Santa Catalina Island and Point Firmin. As Santa Catalina Island is 13 miles nearer to San Pedro than to Port Los Angeles, the protection afforded by it is proportionately greater, but this entrance to the jetties is wholly or partially exposed for 106° , the center of the exposed arc being south 22° east, magnetic.

A considerable growth of long-leaved kelp in the western part of San Pedro Bay indicates the existence of rock on the bottom. A rock marked by the bell buoy on the 5-fathom line is about half an acre in extent, the highest point being 17 feet below mean low water. With this exception, the rock wherever examined has been found to be nothing more serious than loose bowlders, and this characteristic is confirmed by the fact that there are no abrupt changes in the bottom. The limited portion of the bay back of a line connecting Point Firmin with Deadmans Island is more rocky than the rest, indicating that the point may once have extended eastward and included this island. The eastern part of San Pedro Bay appears to be free from all submerged or hidden dangers, while the 10-fathom line is generally from $2\frac{1}{2}$ to 3 miles from the shore.

At neither location can a deep-water harbor which will meet the requirements of the law be constructed within the limits of the present shore line; it can only be made by a breakwater which will furnish the necessary area of protected smooth water behind it. At Port Los Angeles this breakwater must afford protection against southwest seas and swells, the mean exposure being very nearly in the direction of the heaviest swell. At San Pedro the breakwater must afford protection from southeast to southwest. As the breakwater at Port Los Angeles must be some distance outside of the pier and that at San Pedro some distance outside of the present harbor entrance, the exposure will be somewhat increased at the breakwaters, this being especially the case at San Pedro, where a portion of the breakwater must necessarily be beyond the protection of Point Firmin. So far as can be judged from the evidence placed before the Board, from personal observations, and from the direction of exposure, the duties which must be performed by a breakwater at Port Los Angeles would probably be greater and the seas which it might have to resist may be heavier than would be the case with a breakwater at San Pedro. In view of the fact, however, that violent storms and seas are of rare occurrence at either point, it has been thought right to estimate on the

same construction at each place. At either sight a breakwater of lighter section than would generally be demanded is admissible.

The general form of breakwater selected consists of a random stone substructure, terminating at mean low water, surmounted by a superstructure of more regularly shaped rock roughly placed, and finishing 14 feet above mean low water, this being about 7 feet above extreme spring tides; the superstructure to be protected at each end by a block of concrete 40 feet square, finishing 20 feet above mean low water. A cross section of this breakwater accompanies this report. The substructure finishes 38 feet wide at mean low water and 90 feet wide at the assumed approximate plane of rest, 12 feet below mean low water. It has a slope of 1.3 horizontal to 1 vertical for the whole height on the harbor side and below the assumed plane of rest on the ocean side, this being the slope which random rock dumped in water may be expected to assume. For the 12 feet above the plane of rest on the ocean side the slope is 3 horizontal to 1 vertical, affording a flatter slope for the waves to break upon. At the ends the substructure finishes square, with a slope of 1.3 horizontal to 1 vertical, corresponding to that on the harbor side. These are close dimensions, to which the actual construction would conform approximately, and which are used in the preliminary estimates. The superstructure is 38 feet wide at the base at mean low water and 20 feet wide at the top. It is formed of heavy stones of approximately rectangular shape, these stones being laid with their greatest dimensions at right angles to the breakwater and in the form of rough steps, the retreat of these steps being 10 feet on the ocean side and 8 feet on the harbor side. To protect the work from injury from waves passing around the ends, a single block of concrete 40 feet square and 20 feet high is substituted for the ordinary superstructure at each end, this block of concrete forming a monolith of 32,000 cubic feet, weighing 2,000 long tons.

Five different sources of supply were examined for stone for this breakwater. Samples taken from these five sources were sent to the Smithsonian Institution for examination, and the report received is given in Appendix C. The first of these sources is at Chatsworth, a station 30 miles distant from Los Angeles, on the Southern Pacific Railroad. The stone is a soft sandstone of uncertain durability, which the Board does not consider suitable to this purpose. The second is at Declez, on the Southern Pacific Railroad, 48 miles from Los Angeles. The railroad has opened a quarry here, and the amount of stone is practically inexhaustible. It is a very heavy granitic stone of irregular character, some parts being apparently excellent and durable and other parts disintegrating readily, the good and the bad stone differing so little in appearance that they can not always be distinguished by the eye. If nothing better were available this stone could be used. The third source is in the Arroyo Seco, on the Los Angeles Terminal Railway, 14 miles from Los Angeles. At this point there is apparently a large supply of good granite, but quarries are not yet opened. The fourth place is at Casa Blanca, on the California Southern Railway, 74 miles from Los Angeles. Except for distance, this is decidedly the most promising of the railroad quarries. The stone may be considered an excellent gray granite, weighing 170 pounds per cubic foot, in good shape for quarrying, and apparently all sound.

A survey made by the chief engineer of the railroad shows that there are not less than 2,000,000 cubic yards of solid rock available at this point. The fifth source is on the north shore of Santa Catalina Island immediately east of Isthmus Cove, this being the quarry from which the greater part of the stone used in the jetties at San Pedro was taken.

These quarries are 19 nautical miles from San Pedro and 34 miles from Port Los Angeles; the stone is a good quality of volcanic rock, and though somewhat variable in character, its durability is established by the experience at the San Pedro jetties; it is a comparatively light stone, varying in weight from 135 pounds (in a sample weighed by a member of the Board) to 150 pounds per cubic foot, but this is no objection to its use in the substructure. The cliffs can be blasted down at small expense and the stone loaded directly on barges without a second handling. No other quarry offers such opportunities for cheap quarrying and handling, and no other quarry, unless possibly that at Casa Blanca, promises to furnish the same quantity of good stone. Both of the Southern Pacific quarries can furnish an abundance of stone with all desirable speed, but in neither is a large portion of the stone of satisfactory quality; stone from the quarry at Santa Catalina is entirely satisfactory for the substructure. With a suitable plant, this stone can be quarried as rapidly as will be necessary, and handled at much less expense than from any other place examined. While stone from other quarries should be accepted if it fulfills the requirements of the specifications and is not more costly, that at Santa Catalina offers such advantages that the estimates have been made on the conditions existing there.

The amount of stone required for the substructure will be, in round numbers, 2,000,000 long tons. A plant which will handle 2,000 tons daily would, if there were no delays, complete the work in about three years, but with due allowance for contingencies it may require four years. A seagoing tug could make two round trips daily between the quarries and San Pedro, handling two 500-ton barges each trip. It could make two round trips in twenty-four hours between the quarries and Port Los Angeles, but would have to work both night and day. The substructure below the plane of rest can be built entirely from center-dumping barges. The comparatively small portion above the plane of rest would have to be handled from derrick barges. The cost to the Government of the stone placed in the breakwater must cover a charge for the contractor's plant, including derrick barges, dumping barges, and tugs, as well as the cost of towage and other items. A detailed estimate of the cost of the contractor's plant will vary to some extent with the plans and organization of the contractor doing the work. A rather liberal estimate, based upon the cost of barges and tugs either now being used or about to be used in other similar work, shows that if the stone is to be taken to San Pedro the cost of plant may be placed at 15 cents per long ton, and at 20 cents per long ton if the stone is to be taken to Port Los Angeles. In a similar manner an estimate of the cost of towage may be taken at 5 cents per ton to San Pedro and 8 cents per ton to Port Los Angeles.

The cost of quarrying the stone, loading on barges, and dumping at the breakwater site, the latter being a very small item, was also investigated in connection with what has been done at the quarry sites visited, and it certainly ought not to exceed 50 cents per ton. On this basis the following figures are considered a very liberal estimate of the cost per long ton in the work:

	San Pedro.	Port Los Angeles.
Quarrying, loading, and dumping	\$0.50	\$0.50
Plant	.15	.30
Towing	.05	.08
Royalties, contractor's profits, and contingencies	.30	.30
Price per ton	1.00	1.08

Assuming an average weight of 145 pounds per cubic foot, a solid yard of Santa Catalina stone will weigh 3,915 pounds. Assuming the voids in the breakwater to occupy 0.3 of the full volume, a cubic yard of breakwater will weigh 2,740 pounds, which is 1.223 long tons. For purposes of estimate a cubic yard of breakwater can be taken to contain 1.25 long tons of stone, and is estimated to cost \$1.25 at San Pedro and \$1.35 at Port Los Angeles. An additional allowance of 25 cents per cubic yard is made for the stone above the plane of rest, which must be handled by derricks, making the cost of this portion of the work \$1.50 at San Pedro and \$1.60 at Port Los Angeles.

These prices for substructure are lower than have often been obtained, although lower prices are being paid for similar work now under contract. They are lower than the average prices at which corresponding work has recently been let on the Atlantic Coast. The conditions here are, however, unusually favorable for cheap work. Under fair, open competition it is believed that the work can be let for less than these prices. Should higher prices be bid, it is believed that they will mean either combination or that a sufficient number of experienced contractors have not given the subject full consideration.

It is possible that the same stone could be used for the superstructure, but as it is not likely to quarry in regular shapes, and the cost of working the quarries would be materially enhanced by saving selected stone, it is thought best to estimate on getting the superstructure from some other source. It will probably be best to use granite and to bring it in by railroad, transferring it to barges, by which it will be sent to the work. This superstructure is estimated to cost \$3 per cubic yard at each site.

The concrete blocks at the ends should be of Portland cement concrete, of the character used for bridge piers and other massive structures on the Pacific Coast. They will probably cost a little more at San Pedro than at Port Los Angeles, owing to the greater distance to suitable gravel. They are estimated at 20 cents per cubic foot at Port Los Angeles, being \$6,400 for each block, and 22 cents per cubic foot at San Pedro, being \$7,040 for each block.

These prices are used both as a basis of comparison between the two harbors and in the estimates submitted with this report.

Before considering the special features of the two harbors it is important to consider the action of a breakwater. Much has been said of the angle which will mark the line between the still water back of the breakwater and the rough water outside. In point of fact, a breakwater absolutely stops the wave action or the component of such action perpendicular to the breakwater for a distance equal to its length, the corresponding amount of wave force completely disappearing, so that it can not be revived except by new causes producing new waves. It is only necessary to consider the effect of a breakwater carried completely across from one headland to another to realize the truth of this statement. On the other hand, there is no absolute line of demarcation between the still water back of a breakwater and the water on which that breakwater has no influence. Whatever amount of roughness or wave action passing around the ends of the breakwater agitates the water in the area behind it, that wave action must be accompanied by a corresponding amount of stilling outside the limits of such area.

The action of a breakwater on the waves of the sea is similar to the action of a screen on waves of light. A screen produces immediately behind itself a complete shadow over a conical or pyramidal volume of

space, the area of complete shadow decreasing as the distance from the screen increases; outside of this is a region of partial shadow of varying intensity, the area of which increases with the distance from the screen. The same thing happens in the case of a breakwater. The waves are absolutely quieted back of the breakwater for a width which decreases with the distance from the breakwater; they are partially quieted back of the breakwater for a width which increases with the distance from the breakwater; and the amount of the quieting beyond the length of the breakwater is precisely equal to the amount of agitation inside that length. The direction of the shadow or protection is determined, not by the direction of the breakwater, but by the direction of the swell, and will, therefore, vary with the swell. Water beyond what is strictly the protected area may under ordinary storms be sufficiently quiet to make fairly good anchorage, while a portion of the water inside the assumed protected area may be too rough under exceptional conditions for anchorage. There is no clearly defined line of distinction, but a general change, and this will vary with many circumstances. In general it may be stated that the best anchorage will be near to and immediately behind the breakwater.

For purposes of comparison of areas there seems to be no more accurate rule than to draw lines at right angles to the breakwater at each end and assume that the sea between these two lines is protected. Under many conditions there will be fairly good anchorage outside these lines; under certain conditions they give too great a measure. They are assumed, however, for comparison only, as on the whole giving the best and fairest average results.

The principal duty of a breakwater is usually to provide a safe and commodious anchorage. The protected area, though comparatively still, feels to a limited extent the effects of an outside swell. It can not have the absolute quiet which is found in a small landlocked harbor, in an interior basin, or in an artificial dock.

The practice of building unprotected ocean piers is characteristic of the California coast. Where piers of this kind are used, there must be sufficient depth of water to allow ships to rise and fall with a moderate swell, and in rough weather the piers can not be used. If piers are built in the area protected by a breakwater, these difficulties will be greatly reduced. Ships can lie close to the piers instead of being breasted off, but it would not generally be safe to allow them to touch bottom. In a completely inclosed basin no swell whatever is felt and no harm comes to a ship if she occasionally grounds, provided the bottom is soft. This is sometimes done alongside the piers in New York City. It would perhaps be fair to say that at an ocean pier there should be at least 1 fathom of water under a ship's bottom at mean low water; that at a pier in the area protected by a breakwater there should be half a fathom, and that in a landlocked basin only enough water to float the vessel will be required.

A common diurnal range of tides in both San Pedro and Santa Monica bays is about 6 feet, while the extreme of spring tides has sometimes gone about 2 feet below mean low water; at this extreme low water there would be 4 feet of water under a ship lying at an ocean pier, 1 foot under a ship lying at a pier in a protected area, while a ship in an inclosed basin would be aground. Under these conditions, in order to accommodate vessels drawing 30 feet, an ocean pier should be built in 6 fathoms at mean low water, a pier within a protected area in $5\frac{1}{2}$ fathoms, and an interior basin should have a little more than 5 fathoms. The Port Los Angeles pier, which is built in from 5 to $5\frac{1}{2}$

fathoms, would not now at extreme low water afford a safe berth for a ship drawing 30 feet.

After this provisional consideration of the requirements of the law and the protection which may be afforded by a breakwater, the consideration of the two respective harbors may be taken up.

Port Los Angeles.—Whatever questions may arise as to expediency and utility, the situation at Port Los Angeles, so far as the construction of a breakwater is concerned, is very simple. The bay is open in the direction of the greatest swell, and there is here at all times some motion in the sea. The only solution is that of a detached breakwater which shall produce comparatively quiet water behind it. The requirements for a deep-water harbor mean that the greater part of this breakwater shall be located at least 1,000 feet outside of the 7-fathom line.

The location for a breakwater has been proposed in accordance with this provision, and is shown on the accompanying map. Such proposed breakwater consists of two arms, the westerly arm being at right angles to the direction of the greatest swell, which is the same as the direction of the pier, and the east arm being practically parallel to the 7-fathom contour, and a little more than 1,000 feet seaward from it; the west arm intersects the produced axis of the pier 3,000 feet from the end of the pier and 1,000 feet from the 7-fathom line; the two arms intersect each other 700 feet from the intersection of the west arm with the produced axis of the pier. The west arm is 2,500 feet long and the east arm 5,000 feet long, making a total length of 7,500 feet. The west arm has a bearing south $47^{\circ} 36'$ east, magnetic, and the east arm south 75° east, magnetic, the arms making an angle of $152^{\circ} 36'$ with each other.

The borings made on the line of the Port Los Angeles pier prior to its construction, and the experience in pile driving during its construction, showed a hard bottom, generally of clay. A boring made at the same time, between 400 and 500 feet beyond the end of the pier, showed about 8 feet of comparatively soft bottom, below which was the same hard material as on the pier proper. A set of borings made on the line of a suggested breakwater, extending southerly from the Santa Ynez Canyon, and which passed 2,800 feet beyond the end of the wharf, or about the location now proposed for a breakwater, showed 19 feet of very soft mud opposite the end of the pier, and 21 feet of very soft mud with sandstone under it 700 feet northerly from the axis of the pier. All of these borings were made by the Southern Pacific Company, and this information is furnished by its chief engineer.

Seven borings made under the direction of this Board on or near the line of the proposed breakwater showed that this soft material was at least 10 feet deep for the whole length of the breakwater. To prevent any possibility of doubt as to these results, a further set of 18 borings was subsequently made, and a full record of these borings is given in Appendix E. It is evident that the bottom on which this breakwater would be located is not one which can sustain any excessive weight without settlement; how much the settlement would be, it is impossible to determine without actual experiment, and experiments made over a limited area would be of little value; the settlement would certainly be materially less than the depth to hard material, but it is impossible to say how much less it would be. It must be understood that if a breakwater is located here, the amount of material required will depend upon the settlement, and it may be necessary to reduce the length of the breakwater below the length as estimated in this report, with corresponding reductions in the area protected.

The estimated quantities and cost of this breakwater, made on the basis both as to plan and prices given above, and with no provision for settlement, are as follows:

1,350,527 cubic yards substructure below plane of rest, at \$1.35.....	\$1, 823, 211
214,264 cubic yards substructure above plane of rest, at \$1.60.....	342, 822
111,600 cubic yards superstructure, at \$3	334, 800
Concrete blocks.....	12, 800
	2, 513, 633
Add for engineering and contingencies 15 per cent	377, 045
Total	2, 890, 678

The east end of this breakwater is in 8 fathoms of water. The estimated cost of 1 foot of breakwater in 8 fathoms of water is \$337, with no allowance for contingencies. One foot of settlement over the whole base of the breakwater corresponds to 50,000 cubic yards of substructure, costing \$67,500. One foot of settlement therefore corresponds in cost to 200 feet of length of breakwater. To keep the cost of the breakwater within the limit authorized by law, it must be shortened 200 feet for each foot of settlement. If, therefore, we assume an average settlement of 5 feet, which is not excessive, the length of the breakwater must be reduced to 6,500 feet. If lower prices are obtained at the letting, the surplus should be used to provide for settlement as far as it will go.

This breakwater would afford good protection from southerly and southwesterly swells. Against southeast winds it would afford little protection; but, as these winds have little sweep over the water, no protection against seas from that direction is needed. The protected area behind the 7,500-foot breakwater, estimated on the basis heretofore specified, which gives results rather too large, is as follows:

	Acres.
Between breakwater and 6-fathom line.....	338
Between 6-fathom line and 5-fathom line	172
Between 5-fathom line and 4-fathom line	163
Between breakwater and 4-fathom line.....	673

The length of the protection afforded by the breakwater, measured on the several fathom lines, is as follows:

	Feet.
6-fathom line	6, 800
5-fathom line	6, 000
4-fathom line	5, 300
3-fathom line	4, 800

The east end of the breakwater comes opposite a point a little west of the Santa Monica Canyon.

Such a breakwater would afford an excellent anchorage for as large a fleet as is likely ever to be forced there by stress of weather, or to have occasion to wait there for commercial purposes.

The anchorage within the protected area is good. As a harbor of refuge, the harbor so made would meet all necessary requirements. As a harbor for commerce, the only manner in which it could be used is by constructing piers out from the shore to water of necessary depth, and these piers, to accommodate vessels drawing 30 feet, must be about as long as the pier already built. Shorter piers could be built to accommodate vessels of lighter draft, but the shorter the piers the greater the distance from the breakwater and consequently the rougher the water. It has been proposed, and it is feasible, to construct a bulkhead wall a little outside of the 3-fathom line, and fill in behind it. Plans and estimates have been proposed for such work. These estimates indicate

that land can be made in this location at a cost of about \$9,000 per acre, or \$250 per linear foot of bulkhead frontage. This would afford a strip of ground outside of the present railroad track about 1,250 feet wide, and of such length as might be constructed. This strip of made ground and a limited tract at the mouth of and in the Santa Monica Canyon constitute the area within the proper limits of the port, on which the facilities for storage would mostly be located. It would also constitute the site of the various industries and business developments finding encouragement in the immediate vicinity of the harbor. Shops for repairs and dry docks, when built, would necessarily be located in the same area, as no other location would be available. A system of short piers could be built out from the bulkhead, at which small vessels could land, and various plans for other improvements might be suggested.

San Pedro.—The situation at San Pedro is much more complicated, and the solution of the question is more difficult. The entrance to the inner harbor lies but a short distance easterly of Point Firmin, and the anchorage ground is already well protected from the west by the bluff which terminates in this point. The shore east of Point Firmin is rocky, and a growth of kelp indicates that there are occasional rocks in the bottom of the bay. There are also reported to be littoral currents of some force, whose possible action must not be overlooked.

No currents other than tidal currents were observed during the examinations made under the direction of this Board. The weight of evidence given in connection with bodies that have either floated or rolled along the bottom was in favor of a littoral current close inshore from west to east, while it is generally admitted that there is a current along this coast from east to west. The natural effect of a shore current passing along sharp points like Point Firmin is to produce eddy currents in an opposite direction, but such an eddy current is liable to be broken up or changed by any obstruction which may materially alter the shore line. The breakwater must be so located as to shield the protected area from the southwestern swell now reaching it, though that swell gives little trouble to the present harbor entrance, and so as to shut off the sea which is now produced by the southeast winds, both from the anchorage area and the entrance to the inner harbor. Furthermore, this breakwater must be located in accordance with the provisions established for a deep-water harbor at least 1,000 feet seaward from the 7-fathom line.

Three rivers—the Los Angeles, the San Gabriel, and the Santa Ana, all of which in seasons of flood bring down a considerable amount of sand or silt—discharge into San Pedro Bay, though the material which they deposit is not carried very far beyond the place where it is first dropped. The current out of the tidal basin known as Wilmington Lagoon will be discharged into the protected area. While an opening which will allow the southwest swell to enter the protected area may be objectionable, it has been thought best to have an opening so located as to avoid this danger, but through which a littoral current can pass in either direction, whether it be the current which is now thought to exist or a new current created more or less by the existence of the breakwater, and which will tend to prevent the fouling of the harbor by sewage or other disturbing causes.

A breakwater which is believed to meet all these requirements has been located and is shown on the map accompanying this report. The breakwater consists of two arms connected by a curve of 1,910 feet radius, the curve being used principally as a measure of economy, since the total length of the structure is decreased and as the intersection of

the two straight lines would fall in somewhat deeper water than the curve. The west arm has a course bearing south 72° east, magnetic, and is 3,000 feet long. The east arm has a course bearing north 54° east, magnetic, and is 3,700 feet long. The two are connected by a curve of 1,910 feet radius, 1,800 feet long, in which there are 54° of curvature, making the total length of the breakwater 8,500 feet. The location is definitely fixed by the fact that at a point 3,000 feet from the end of the breakwater the produced axis of the breakwater bears north 18° east, magnetic, from the center of the Point Firmin Light-House, and is 3,500 feet distant therefrom. The west end of the breakwater is about 2,100 feet from the present shore line, and bears north 52° east from Sentinel Rock on Point Firmin and north 38° east from the most advanced point of the 1-fathom line. The opening is therefore protected by Point Firmin from the southwest swell, as any such swell before entering this opening must break in the shallow water back of the 2-fathom curve.

The effective opening between this breakwater and Point Firmin varies with the direction of the sea; it is greatest from the south. Winds from this direction have only a sweep of 18 miles from Santa Catalina Island. The clear opening to the southwest swell is very small, and whatever swell enters must come over a bottom less than 2 fathoms deep. Should it be found necessary, the southwest swell could be entirely excluded by a short breakwater, hardly more than a groin, built in shallow water, on rocky bottom, a little east of the light-house. The opening left between the breakwater and the point is considered enough to pass a current which will prevent the accumulation of sand in the protected area, and prevent fouling; the opening would also, in smooth weather, be a convenient entrance or exit for light-draft coasting vessels.

Eight borings were made on the line of this breakwater. The eastern boring (8,000 feet from west end of breakwater) showed soft fine sand similar to that found at Port Los Angeles. In all other cases gravel or hard clay was found with, in three instances, from 1 to 2 feet of soft clay or mud on the surface. The material was so hard that in eight borings it was not thought necessary to bore more than 6 feet into the bottom. These borings indicate excellent foundation for this breakwater. It has not been thought necessary to make any additional allowance for settlement beyond that included in the contingent percentage. Some settlement may take place at the east end, but not over a length exceeding 1,000 feet, and if it should average 5 feet the extra cost would be balanced by shortening the breakwater 150 feet. At the same time an examination was made of the points within the protected area where rock had been reported in the soundings. These rocks proved to be boulders or float of small dimensions except in one instance, and that is near the bell buoy, where rock of an area of perhaps half an acre on the edge of the protected area was found at depths varying from 17 feet to 26 feet below mean low water.

The estimated quantities and cost of this breakwater, made on the basis both as to plan and prices which has been given above, are as follows:

1,412,934 cubic yards substructure below plane of rest, at \$1.25.....	\$1,766,167
242,764 cubic yards substructure above plane of rest, at \$1.50.....	364,146
126,300 cubic yards superstructure, at \$3.....	378,900
64,000 cubic feet of concrete, at 22 cents.....	14,080
	2,523,293
Add for engineering, contingencies, etc., 15 per cent.....	378,494
Total.....	2,901,787

It is believed that the anchorage area afforded by this breakwater will meet all requirements for many years, but if it should ever prove inadequate, more area can readily be added by extending the eastern arm. This breakwater would afford complete protection from all seaward directions, while the east and northeast winds, coming from the shore, require no protective provision. Any seas which might pass around the west end of the breakwater could only reach shallow water, where no vessel would be anchored. The protected area behind this breakwater, estimated on the bases heretofore specified, is as follows:

	Acres.
Between breakwater and 6-fathom line.....	273
Between 6-fathom line and 5-fathom line	135
Between 5-fathom line and 4-fathom line	207
Between breakwater and 4-fathom line	615

The deep-water area is somewhat less than that afforded by the Port Los Angeles breakwater, but is ample for all requirements for many years to come; as the west arm crosses the 5-fathom and 6-fathom lines, the protection is complete in this direction and the reduction by reason of waves angling around the end would occur only at the end of the east arm. The length of the protection afforded by the breakwater, measured on the several fathom lines, is as follows:

	Feet.
6-fathom line	6,200
5-fathom line	6,800
4-fathom line	7,900

The center of the entrance to the present inner harbor falls 2,800 feet inside of a line drawn at right angles to the east arm of the breakwater at its east end.

The character of the holding ground within the protected area is admitted by all parties to be good. It is perhaps in places a little too hard, but not enough so to form any substantial objection. As a harbor of refuge the area behind this breakwater would seem to meet all reasonable requirements. It could be used as a harbor for commerce by building long piers out from the shore, as has been done at Port Los Angeles. To reach the same depth of water these piers would have to be about 3,000 feet longer than the Port Los Angeles pier, but one-half of the length would be an approach in shallow water, which could be replaced by a solid embankment, the construction being no more expensive in character than that of the Southern Pacific Railroad between Wilmington and San Pedro. The approaches to such piers would be practically without grade and immediately adjacent to the railroad tracks now in use, as well as to the facilities of the existing inner harbor. The inner harbor, however, affords possibilities which may make the construction of such piers inexpedient.

The inner harbor now accommodates vessels drawing 18 feet, there being 14 feet on the bar at low water. The entrance is between stone jetties 700 feet apart. The harbor as now utilized extends 9,000 feet from the mouth of the jetties to the lower end of Wilmington Lagoon, a tidal flat basin having a high-water area of about 2 square miles and a tidal prism corresponding perhaps to an average depth of 3 feet at high water. About 4,000 feet of this channel, from the Southern Pacific passenger station north, is now occupied by wharves, which are practically continuous on the west side of the channel, these wharves forming a longitudinal quay, alongside of which vessels are berthed. For 3,000 feet south of the Southern Pacific wharf there are mud flats

on each side of the channel in which basins could easily be excavated, there being room for a basin more than 2,000 feet long and at least 500 feet wide on the west side and for one of about half these dimensions on the east side of a channel 600 feet wide. The east basin could be enlarged indefinitely by removing the present jetty farther east.

To ascertain the possible developments of this inner harbor a series of borings was made, extending from the upper end of the wharves into the outer bay and beyond the 5-fathom line, these borings being generally carried to a depth of at least 6 fathoms below mean low water. A full report of these borings is given in Appendix D. These borings show that for a distance of 1,200 feet inland from the end of the jetties the bottom above the 5-fathom line is a hard, black, sandy clay, impregnated with petroleum, in or on which a few boulders are found; it is a material through which a pipe was forced slowly by the use of a water jet, and a material which can be worked without serious difficulty by a hydraulic cutter dredge. Outside of the jetties this same material is found, but it sinks rapidly and drops below the 5-fathom line about a thousand feet from the end of the west jetty, the deposit above it being generally sand with a little mixture of gravel. Beyond the limits of the hard material, the bottom of the harbor, wherever examined, was practically pure sand, easily handled by a suction dredge. To open a 30-foot channel 400 feet wide from the upper end of the present wharves to the 5-fathom line in San Pedro Bay would require the removal of about 2,000,000 cubic yards of material, all of a class which could be readily dredged, and to open a channel 24 feet deep of the same width would take about half of this amount.

While the tidal basin of the Wilmington Lagoon is not large enough to make a tidal current which would scour away the bar, it is large enough to prevent the silting up of a channel once opened. To accomplish satisfactory results it would probably be expedient to extend the present jetties to the point where 24 feet of water is first reached, this being 1,200 feet for the west jetty and 1,500 feet for the east jetty, requiring from 100,000 to 150,000 cubic yards of rock, which, if it were handled by the same fleet that handles the rock for the breakwater, could be done for the same price. The total cost of opening a 24-foot channel for the distance named would be less than the cost of the Port Los Angeles pier and the cost of increasing the depth to 30 feet would not be very much greater. The present channel between the jetties points almost exactly southeast, magnetic, and this would be the natural direction in which to extend the jetties. There is now a bar directly opposite the mouth of the jetties, to avoid which vessels passing in and out have to make a short turn. The existence, or at least the continuance, of this bar appears to be due largely to the action of the southerly seas, which would be shut off by a breakwater, so that it is believed that there would be little difficulty in maintaining a straight entrance and even in continuing a 5-fathom channel beyond the end of the jetties to the present 5-fathom line. The inner harbor would be purely a tidal harbor, with no tendency to silt up except from local carelessness; the sewage from any town that might grow up here should be discharged outside of the jetties; a proper system of bulkhead construction would keep out the wash from the adjacent land, and a restraining wall, similar to that at San Diego, constructed east of the Wilmington Lagoon, would divert the deposit from the Los Angeles and San Gabriel rivers.

While the extension of the jetties and the deepening of the inner harbor may not be a necessary part of the immediate construction

required for the deep-water harbor provided for by law, they certainly are accessories which would within a reasonable time and at a reasonable cost enable this harbor to meet every possible requirement of commerce in the most complete and satisfactory manner. The possibility of such improvement of the inner harbor bears, in commercial development, much the same relation to the outer harbor at San Pedro that the possibility of filling behind a bulkhead bears to the protected area behind the breakwater at Port Los Angeles.

Comparison.—In comparing the two harbors for the purpose of establishing, as between them, the best location for a deep-water harbor for commerce and of refuge, it is necessary to consider not only at which point the best harbor can be made, but at which point a harbor, when so made, will be most useful. If the location at which the best harbor can be made is also the one at which a harbor will be most useful, there can be no doubt which place should be selected. If a harbor which will meet the requirements of the law can only be made at one of the two places, that location should undoubtedly be chosen. If, however, a harbor can be constructed at each point which will meet the requirements of the law, the location at which a harbor will be most useful is the one which should be preferred.

The estimates and descriptions already given show that a harbor can be constructed at either point which will meet the requirements of the law. The only contingency is the soft bottom in Santa Monica Bay, and this is simply a question of additional material and cost. At each place a good deep water anchorage in 6 to 8 fathoms of water can be obtained. At either place the necessary accessories for the convenient transfer of business from shipping to land can be constructed. At Port Los Angeles these accessories must be in the form of piers built out into the sea and of such other facilities as may be afforded on made land behind a bulkhead wall. At San Pedro corresponding provisions can be best furnished by the improvement and deepening of the inner harbor until those improvements may be completed; timber piers extending out to deep water can readily be constructed. In determining which harbor will be most useful, five different considerations must be reviewed: Convenience for construction of accessory works; approaches from the sea; approaches from the land; availability as a harbor of refuge; capacity for extension and enlargement as demands of commerce may require.

The accessory works which must be considered are of three classes: Direct means of exchanging traffic between land and water transportation; facilities for convenient storage of goods which must be held while awaiting consignment, and accommodation for maintenance and repair of vessels using the port. At Port Los Angeles a pier to accommodate vessels drawing 30 feet should be built in $5\frac{1}{2}$ fathoms of water. The present pier can be made to meet these requirements by a small amount of dredging on each side. This pier projects 1,000 feet beyond the 5-fathom line, and the fullest development of this harbor would probably be a series of piers projecting from the 5-fathom line in connection with made land, formed by filling back of a bulkhead wall just in front of the 3-fathom line. The length of the protection on the 5-fathom line has been given at 6,000 feet, which might be reduced to 5,000 feet if the breakwater is shortened to balance the cost of settlement, and as this line is 3,000 feet back from the breakwater there would be a considerable swell at each end of this protection. It would probably be inexpedient to build any pier within 1,000 feet of each end of the calculated protection limit, and even in this case vessels prob-

ably could not lie on the outer side of the two outer piers in rough weather. The total length, therefore, within which piers could be built would be about 3,000 feet, giving room enough for eight piers 100 feet wide with seven intermediate basins 300 feet wide. This would afford 14,000 linear feet of wharfage alongside the piers without considering the exposed sides of the two end piers.

Additional wharfage for light-draft vessels could be furnished on the shore extensions of piers back of the 5-fathom line. So far as conveniences for unloading are concerned, this would seem to be ample. There are two objections: Each of the eight piers, including its approaches, is at least 4,000 feet long, and would represent a cost of something like \$300,000, exclusive of such buildings, fittings, and the like as might be put upon it, making the cost of the eight piers about \$2,500,000, nearly all perishable property, which, even with creosoted piles and the best construction, would probably not last more than twelve to fifteen years, and on which the annual interest and depreciation would not be less than \$300,000. The concentration of such a large amount of timber work in this position would involve unusual fire risks, and unless excessive insurance rates were paid it would probably be necessary to place piers of this length much farther apart, probably reducing the number from eight to four. The length of the inner harbor at San Pedro, from the south end of the mud flats near Deadmans Island to the north end of the present wharves, along which it is proposed to deepen the channel, is 7,000 feet, thus affording on the two sides of the harbor the same amount of wharf face that the eight piers would furnish at Port Los Angeles, while this 14,000 feet could be increased to 20,000 by the proposed basins and cross piers in the present mud flats, besides which the whole of the Wilmington Lagoon is available whenever the needs of commerce demand it. Within this inner harbor vessels could lie perfectly still in all weathers without even the reduced sea which would exist within the protected area behind a breakwater. Railroad tracks now exist on each side of this harbor, and these could be extended along the whole water front. The timber construction would be a narrow line of wharf between the bulkhead and deep water (excepting where piers are used in basins), accessible for its whole length from both land and water, which could be replaced at any time by more permanent work and could readily be protected from fire.

So far as the direct means of exchanging traffic between land and water transportation are concerned, San Pedro affords greater advantages than Port Los Angeles. Prior to the completion of these improvements of the inner harbor, it is reasonable to assume that one suitably designed timber pier, located a safe distance on either side of the jetty entrance and practically carried out to the 5-fathom line, would accommodate those vessels whose draft would prevent their entrance to the inner harbor. Should more water be needed alongside the piers, it can be obtained at comparatively small expense by dredging. The objections of fire risk and perishable character would apply to such a pier, but it should be regarded, if constructed, as a temporary feature of the deep-harbor development and not as a permanent part of it.

At Port Los Angeles there is at present no room for the storage of cargoes except the coal bunkers on the pier. Warehouses can be built on piers, but they would be subjected to all the risks attendant on pier construction. Land can be made for warehouse and other purposes, at large expense, between the present shore and the 3-fathom line, or even farther out; goods to be put in warehouses so located must, however, be handled from vessels to cars which will run lengthwise on the

piers and then unloaded again into the warehouses, thus requiring an extra handling; as the handling costs more than the movement, it might be best to erect such warehouses at some distance from the piers and transport the goods by rail. At San Pedro warehouses or storage yards can be provided back of the bulkhead line for the whole length of the harbor, in the most convenient possible position for landing and handling cargoes; practically this is now done in the lumber yards in the upper part of this harbor. In this respect San Pedro has decided advantages.

Accommodations for maintenance and repairs of vessels have not been given the attention in American ports that they have received abroad. This is probably due largely to the fact that a considerable portion of our coastwise trade is still handled in wooden vessels, which require comparatively little attention. The foreign trade, however, is now almost entirely handled in iron ships and steamers, and the coasting trade will eventually be handled in the same class of vessels. These iron ships foul rapidly and should be taken out of the water and cleaned at least twice a year. It is the English practice to have at least one and frequently several dry docks in every important port. Such facilities could be provided near the shore at Port Los Angeles between the piers, and, although the ground must be made, there would probably be ample room. Much better opportunities for works of this class are afforded on the edge of Wilmington Lagoon, in positions where there will be abundant room on shore for machine shops and other accessories. In this respect San Pedro offers advantages far superior to those at Santa Monica.

Passing now to consideration of approaches from the sea, there is no great difference between the two locations; the approach to both harbors is clear and free from danger. The distance from Point Concepcion to is Port Los Angeles is 102 miles and from Point Concepcion to San Pedro 120 miles; for all coasting trade coming from the north, Port Los Angeles has an advantage of 18 miles. The distance from Point Loma to San Pedro is 82 miles and from Point Loma to Port Los Angeles 105 miles; for all coasting vessels approaching from the south, San Pedro has an advantage of 23 miles. The principal trade along this coast now is the coasting trade with San Francisco and other northern ports; for this business Port Los Angeles has the advantage of 18 miles in distance. If a foreign trade is developed at the southern California deep-water harbor, this trade must approach the harbor either from the open sea or from the south, coming around Cape Horn or through an isthmian canal. As a harbor for foreign commerce and commerce exchanged with Atlantic ports, San Pedro has a small advantage as to distance; if it is to be considered that the deep-water harbor to be created under the provisions of the law is to be a harbor for foreign commerce rather than for the coasting trade, there is a slight advantage as to distance with San Pedro, but it is not of sufficient importance to be given weight in the choice of a location.

In the matter of approaches from the land, Port Los Angeles is now connected with Los Angeles by a single line of railroad, the Southern Pacific, while a second line, the California Southern (Santa Fe system), terminates at Santa Monica, 2 miles away. There are no physical difficulties in the way of extending the Santa Fe tracks to Port Los Angeles, and there is abundant room to lay additional tracks between the bluffs and the sea. The only difficulties to be apprehended are such as would arise from the destruction of the Santa Monica beach and the interference with vested rights of private owners and corporations. There are

at present two lines of railroad from Los Angeles to San Pedro, one terminating on each side of the inner harbor. The difference in the present facilities of communication between Los Angeles and the two harbors is immaterial. The distance is slightly greater to San Pedro; the grades are a little heavier on the Santa Monica line. The present lines of communication, however, may be much less important than those which will be developed when a first class harbor is established at one or the other of these ports.

The productive area of southern California lies principally in three valleys which are drained respectively by the Los Angeles, San Gabriel, and the Santa Ana rivers: all three of these rivers discharge into San Pedro Bay, so that this bay can be approached from either one of the three valleys without crossing a summit; the Los Angeles and San Gabriel valleys really unite above Los Angeles, the city lying in the combined valley of the two rivers. The Santa Ana Valley, however, lies farther east and is the valley through which both the Southern Pacific Railroad and the Southern California Railway approach the Pacific Coast, the freight line of the California Southern coming down this valley almost to the coast. Practically the only line of access to Port Los Angeles is by way of Los Angeles, and it is 25 miles farther from all interior points than Los Angeles. At the place where the Southern California Railway leaves the Santa Ana Valley to turn north toward Los Angeles, it is nearer San Pedro than it is to Los Angeles, the intervening country being perfectly flat. By extending its present Riverside Branch down the Santa Ana Valley, the Southern Pacific would reach San Pedro in a distance little or no greater than its present distance to Los Angeles and with the avoidance of all summits. If the deep-water harbor is to be regarded as the terminus of transcontinental lines, where business to and from eastern ports and cities is to be transferred from rail to steamers or from steamers to rail, San Pedro would have the advantage of at least 25 miles in length of railroad transportation over Port Los Angeles, and with the further advantage of lower grades in leaving it, besides avoiding the expense and inconvenience which always attend the forcing of a heavy freight traffic through a large and growing city.

Considered as a convenient harbor of refuge, there is little difference between the two. Either would be easily accessible from the open sea, and the comparative ease with which a ship would reach the break-water protection at one or the other would depend chiefly on her direction of approach when she decided to seek refuge; occasions, however, in which ships would seek such protection from the open sea are comparatively rare. It is not probable that the practice of building unprotected ocean piers will be discontinued; where they can be used they offer advantages of local convenience which are not likely to be abandoned; in specially rough weather these piers can not be used and the vessels which would otherwise land there must either seek the safe anchorage of a harbor of refuge or the open sea. That harbor of refuge is likely to be most used which will be convenient to the greatest number of piers of this kind. For purposes of comparison the Port Los Angeles pier can not be considered, as, if the breakwater is built at that port, it will cease to be an unprotected ocean pier. Ocean piers can however be built farther east in Santa Monica Bay, and a considerable business is now handled over the ocean pier at Redondo (there are really two piers under a common ownership here). There is an ocean pier at Newport, 20 miles east of San Pedro, and the experience of the smaller pier at Long Beach shows that ocean piers can be built

here without difficulty. These conditions indicate that a protected harbor will be more convenient for shipping at San Pedro than at Port Los Angeles, and on the whole it is probable that it would be used more as a harbor of refuge if located at San Pedro.

Considered with reference to capacity for extension, the breakwater at either location can be extended eastward sufficiently to meet all probable future requirements.

The plans of the harbors considered for the two locations differ materially from those considered by the Boards of engineer officers which have heretofore reported on these locations. This difference is due primarily to the fact that the law under which this Board is appointed distinctly specifies a deep-water harbor. The conditions which this requirement makes necessary have led this Board to locate a breakwater at Port Los Angeles about 1,000 feet farther from shore than the previous locations, and in about one fathom deeper water. At San Pedro it has seemed expedient to accomplish the same result by moving the entire breakwater and anchorage eastward, thus excluding from the protection of the breakwater the rocky area immediately east of Point Firmin and leaving between the artificial breakwater and the point an opening for the free passage of water, which opening is itself protected by the natural breakwater of Point Firmin.

Since the subject of a deep-water harbor in this general location was first broached great changes have taken place, both in the requirements of deep harbors and the methods used in their maintenance. Draft and size of ships have increased, improvements in excavating machinery have greatly reduced the cost of dredging and increased the speed and facility with which it can be performed. Hydraulic dredges of the Bowers type, in which stiff material is broken up with cutters and transported by water through long pipes, can now be operated in every class of earth and some of the softer classes of rock, the cost of moving this material (except when it is actually rock) seldom exceeding 15 cents per cubic yard and sometimes falling as low as 5 or 6 cents. Hydraulic dredges without cutters, of the type used in the Gedney Channel at Sandy Hook and on the Galveston Bar, excavating sand or mud which they store in tanks within their own hulls and carry to dumping grounds miles away, have done this work for 10 cents a yard when the place of deposit has been from 3 to 4 miles distant from the place of excavation, including a full allowance for value and depreciation of plant. Furthermore, it is not probable that the limits of this reduction in cost have yet been reached. On the other hand, the cost of timber piers must constantly increase as the supply of suitable timber becomes reduced. These changes are in favor of a harbor where commercial facilities are afforded by interior basins rather than by exterior wharves, in which basins perishable types of bulkheads or piers may be displaced by permanent structures of such reasonable cost as the growth of commerce may justify.

Considered as a deep harbor for international and foreign trade, the advantages which San Pedro has for handling traffic and for approaches by land are great; considered as a harbor for the coasting trade, the facilities for handling outweigh the disadvantage of greater distance from northern ports; considered as a harbor of refuge, the location at San Pedro is likely to be used more than the other, though the difference may not be great; considered with reference to future enlargement and extension, San Pedro offers much greater possibilities than Port Los Angeles. These advantages mean that a deep-water harbor at San Pedro would be more useful than a deep-water harbor at Port Los Angeles.

In the consideration of all matters bearing upon the selection of the harbor site, this Board has constantly kept in view the necessity for such plans and provisions, within the meaning of the statute, as will best meet all possible harbor requirements, both those of the present and those that may arise from future developments. This involves much more than the simple location of a breakwater, or devising imperfect facilities to meet in a more or less limited manner some of the principal requirements of a deep-water harbor for commerce and of refuge. It has appeared clearly the duty of this Board to select that location which will be capable of a development at reasonable cost, commensurate with the growth of all classes of commerce on the coast of southern California, and which, under that development, will afford in the highest degree the various land and water facilities characteristic of a complete deep-water harbor.

Although the location at Port Los Angeles affords all that is needful for a satisfactory harbor of refuge, it is deficient in the facilities necessary for the harbor for commerce contemplated under the law. At San Pedro, on the other hand, a large expenditure has already been made for the improvement of the channel leading into the inner harbor and in the inner harbor itself. The series of examinations made under the direction of this Board also show that any further improvement that may be needed can readily be made, and that the possibilities for the further development of the interior harbor are equal to any demand upon it which the future can be expected to make. It is the conclusion of this Board, therefore, that the opportunity for a harbor of refuge as planned for San Pedro and the availability of both the interior harbor and Wilmington Lagoon for improvements and development to any extent that can now be anticipated meet more fully the requirements of the law than the possibilities offered at Port Los Angeles.

While the physical advantages of the San Pedro location naturally lead to its selection, the advisability of that choice is materially strengthened by the consideration of the extensive improvement of its interior harbor, already made, conditionally provided for, or contemplated as the object of future appropriations. If the choice of the deep-water harbor site should fall to Port Los Angeles, the present statute would then authorize improvements at the San Pedro location to the amount of \$392,000 under Lieut. Col. W. H. H. Benyaure's project of June 8, 1894, and the same statute unqualifiedly directs the Secretary of War "at his discretion" to cause surveys and estimates to be made for further improvements at the same location, so as to secure a depth of 25 feet at mean low water in the channel and interior harbor. In the broad consideration of this question, therefore, it must be assumed that the improvement of the channel and interior harbor at San Pedro will be continued. If the expenditure of public money is to be devoted to harbor purposes in this section, its division between the two points considered will fail to secure that efficiency in results which would be attained by the same total expenditure at one of the two locations. It is the judgment of this Board that the best public policy, both in the interest of economy and for the attainment of a deep-water harbor for commerce and of refuge demands the concentration of expenditures at one point, with the corresponding cumulative excellence of results, rather than a dispersion and weakening of results by a divided expenditure at the two locations. This conclusion gains considerable force through the fact that the selection of the San Pedro site will for the reasons stated undoubtedly involve materially less ultimate total expenditure than is certain to be incurred by the inevitable construction and maintenance of two harbors if Port Los

Angeles were to be selected. The preponderance of physical advantages, therefore, which leads to the selection of the San Pedro location, is in line with the requirements of the best public policy as to the matter intrusted to the decision of this Board.

Taking all these considerations together, this Board reports in favor of San Pedro as the location for a deep-water harbor for commerce and of refuge in southern California.

The Board submits among the drawings accompanying this report plans showing the location and general dimensions of the breakwater recommended. Specifications for this breakwater are given in Appendix A, and the estimates are contained in Appendix B.

This Board desires to express its obligations to Gen. W. W. Duffield, superintendent of the United States Coast and Geodetic Survey, for the use of the steamer *Gedney* for the hydrographic work done at the two harbors; to Lieut. Commander A. P. Osborn, U. S. Navy, commanding surveying party, and to his assistants; to the United States Light-House Board for the use of the steamer *Madrono*, and to Commander Frank Curtis, U. S. Navy, inspector of the Twelfth light-house district; to Mr. William Hood, chief engineer of the Southern Pacific Company, for much valuable information; to the Los Angeles Chamber of Commerce for the use of its rooms during the public hearings; to Messrs. Banning Bros., and to the officers of the Southern Pacific Railroad, the Southern California Railway, and the Los Angeles Terminal Railway for aid and courtesies rendered.

Respectfully submitted.

J. G. WALKER,
AUG. F. RODGERS,
WM. H. BURR,
GEO. S. MORISON.

The SECRETARY OF WAR.

LIST OF APPENDICES.

	Page.
A. Specifications for breakwater	30
B. Estimate of cost of breakwater	32
C. Report of Smithsonian Institution on stone	34
D. Report of Randell Hunt on borings at San Pedro	35
E. Reports of E. Gerber and Randell Hunt on borings in Santa Monica Bay ..	38
F. Stenographic report of testimony at public hearings in Los Angeles	43
G. Tonnage of the ports of Port Los Angeles and San Pedro	203

PLANS.

1. Cross-section of plan of breakwater; scale 1/4".
2. Chart of San Pedro Bay and Harbor, showing location of breakwater; scale 1/1000.
3. Map of San Pedro Bay and Harbor, showing location of breakwater and suggested method of utilizing inner harbor and location of piers in outer harbor; scale 1/1000.
4. Chart of inner harbor at San Pedro, showing soundings made February, 1897; scale 1/1000.
5. Chart of Port Los Angeles and Santa Monica Bay, showing location of proposed breakwater; scale 1/1000.

MINORITY REPORT.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 26, 1897.

SIR: Referring to my letter of the 8th instant inclosing copy of the report of March 1, 1897, by the Board constituted under the provisions of the river and harbor act of June 3, 1896, to locate a deep-water harbor for commerce and of refuge at Port Los Angeles, in Santa Monica Bay, California, or at San Pedro, in said State, I have now the honor to submit the accompanying copy of the minority report of said Board and to recommend that it accompany the papers which were furnished with my letter of March 8, above mentioned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

LETTER OF CHAIRMAN OF BOARD.

BOARD FOR LOCATING A DEEP-WATER HARBOR IN
SOUTHERN CALIFORNIA,
Washington, D. C., March 15, 1897.

SIR: I have the honor to herewith transmit a minority report with reference to the location of a deep-water harbor in southern California, signed by Richard P. Morgan, esq., one of the members of this Board.

I am, with great respect, very truly, yours,

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

The SECRETARY OF WAR.

MINORITY REPORT OF MR. RICHARD PRICE MORGAN.

BOARD FOR LOCATING A DEEP-WATER HARBOR
IN SOUTHERN CALIFORNIA,
Washington, D. C., March 15, 1897.

SIR: The undersigned, one of the Board appointed to locate a deep-water harbor for commerce and of refuge at Port Los Angeles, in Santa Monica Bay, California, or at San Pedro, in said State, is unable to concur in the report dated March 1, 1897, signed by John G. Walker, rear-admiral, United States Navy; Augustus F. Rodgers, assistant United

States Coast Survey; George S. Morison, and William H. Burr, selecting San Pedro, for the following reasons; also understanding that a decision of a majority of this Board is final, the undersigned does not feel justified in fully elaborating the reasons which govern his action, but it seems only proper that a brief statement should be made of those which appear to be the most important.

First. That if it was the duty of the Board to present for the consideration of Congress a scheme for an extensive development of Wilmington Harbor and its exterior connection with the proposed deep-water harbor in San Pedro Bay, sufficient data should have been acquired to enable the Board to make at least approximate plans and specifications and specific estimates of its cost.

Second. Because this was not done, all that is said in the report, indicating that such improvement can be made permanent at moderate cost, is not well founded, and would perhaps be misleading to Congress.

Without presuming to make an estimate of its cost, based upon the meager data acquired by the Board, careful observation of the conditions and the comparatively small results already obtained in that harbor by the expenditure of \$1,000,000 by the Government make it clear that the cost of the suggested development would be very great.

Third. Because, should this work be done, its benefits, locally at least, would almost wholly inure to two railway companies; much the greater part to the Southern Pacific Company on the west side, and on the opposite side a less part to the Los Angeles Terminal Railway Company. These companies mainly and also two or three individuals, in small proportion, practically own all the land adjoining and extending from the exterior lines of the contemplated improvement, and they also own the only feasible approaches to the bay and the deep-water harbor; therefore this great expenditure would probably eventuate in a serious monopoly, adverse to sound public policy.

Fourth. Because the site selected for the proposed breakwater to create the deep-water harbor, to say the least, is extremely difficult of success. It is conceded by the report that a breakwater 8,500 feet in length is required, which fully exhausts the appropriation, and it is also admitted that an additional breakwater on the west, in a most trying position, may be necessary, but no estimate of its cost is given.

The principal cause of the difficulty encountered in constructing a successful deep-water harbor for the purposes of commerce and of refuge at San Pedro is found in the fact that the ocean exposure to overcome is at least 156° , and not 102° , as hitherto stated in the several reports made. The often-repeated statement, when comparing San Pedro and Santa Monica, that "the aggregate angle of exposure of the two bays is therefore the same" is error. Whatever protection may be afforded to the natural conditions at San Pedro by Santa Catalina and San Clemente islands, it does not in the slightest degree modify the extent or character of the proposed breakwater; all of the plans hitherto made, as well as the one accompanying the report, extend across this arc of exposure, 48° , which has hitherto been deducted, because it was assumed to be protected by the islands near its focal point. A practical test of this theory is found in the fact that the transverse sectional form and strength of all the breakwater plans that have been prepared for this location, and embracing the 48° , are uniform at equal depths throughout their length.

Referring to the actual storm results, the following is quoted from the report of the Board of engineer officers, December 8, 1891:

The record of vessels wrecked at San Pedro shows with one exception that the disasters occurred during the southerly storms, the heavy seas coming to the

eastward of Catalina Island. The vessels were driven ashore on the west line of the bay; among those lost were the *Nicholas Biddle*, *Callao*, *Adelaide Cooper*, *San Luis*, *American*, *R. P. Buck*, and *The Kennebec*. The exception noted was that of *The Amy*, which was driven ashore at Point Firmin during a northeast storm from the Santa Ana wind gap.

This statement of facts is confirmed by the report of the Board of Engineer Officers of October 27, 1892; also by the testimony taken by this Board. It demonstrates that a breakwater constructed on the location adopted will not afford full protection to that part of the bay lying between the protected deep water of the harbor and Deadmans Island, the entrance to Wilmington Harbor, a distance of about 5,000 feet, and also extending an equal distance to the west shore line of the bay.

This is again confirmed by the following facts: An important arc of 17° of the entire exposure at San Pedro, 156° , is inside of Point Loma between south 56° east and south 73° east, having an average distance across the bay of 85 miles, the water being 100 fathoms and more in depth.

There is still another arc of 5 degrees to be spoken of as important between south 73° east and south 78° east, having an average distance across the bay of 65 miles, Point San Juan Capistrano being the minimum distance, 50 miles. The water across this bay is more than 100 fathoms deep, except at the shore approaches at each end.

The testimony of persons, mariners and others, who have been familiar for many years with the storms in the vicinity of the proposed sites for a harbor, is practically unanimous that the severest are from the southeast, and it is a matter of such common knowledge, that the storm is designated and familiarly known as the "southeaster." The testimony as to the rise and action of this storm is that it originates in the east, works around to the southeast, and holds at that point for from twelve to forty-eight hours, and sometimes even longer. Whenever the wind begins to shift around from the southeast to the south the force of the storm is broken, and it continues to move around rapidly to the west and northwest, with rising barometer and assured fair weather. The effect of the storm is to produce a sea of considerable size and force, according to its severity, running in from east by south and south by east, until the storm breaks and moves around to the southwest, and finally west by north or northerly, there becoming the prevailing fair-weather wind, which is inconsequential in force.

One of the ultimate results of these gales seems to be to produce, following their termination, long ocean swells, running upon the coast from the southwest and west, and lasting from twelve to thirty-six hours.

A careful examination of the effects produced by these storms from first to last upon the coast from Point Dume to Point San Juan Capistrano confirms the testimony of mariners and other persons, as also does the history of the wrecks at San Pedro. Therefore these facts and statements can be regarded as the safest guide.

If the sea raised within the arcs of exposure spoken of between south 56° and south 78° east is not always at the commencement of "southeasters" dangerous in San Pedro Bay, the evidence still shows that it is dangerous occasionally, therefore the bay between the deep-water harbor and the entrance to Wilmington Harbor will be at times very much exposed, and even the deep-water harbor itself to a considerable extent.

Fifth. The area of the proposed harbor is kelp grown.

Sixth. The line of incidence of the waves coming from the southeast and south with the west arm of the breakwater forms an acute angle; also the ocean swells from the southwest strike the east arm in the same way. The entire breakwater is exposed to the severest action of the greatest storm waves and ocean swells.

Port Los Angeles.—The undersigned presents the following reasons why Port Los Angeles is the better site for the proposed harbor:

First. The entire arc of ocean exposure to be met is only 104° , instead of 156° at San Pedro. (See Appendix A.)

Second. Because a breakwater 6,500 feet long, constructed on the location adopted (assuming that storm waves and ocean swells angle into the harbor $22\frac{1}{2}^{\circ}$ at each end of the breakwater) will protect 3,320 feet in length on the 7-fathom line, as against 3,190 feet at San Pedro with a breakwater 8,500 feet long. This 7-fathom line was adopted by the Board for the anchorage line, and not to be less at any point than 1,000 feet from the breakwater.

Third. That a breakwater at Port Los Angeles 6,500 feet long will protect in excellent form an area of 123 acres, 7 fathoms and more in depth, and a total area of deep-water harbor, 6 fathoms and more in depth, of 250 acres.

At San Pedro a breakwater 8,500 feet in length does not so perfectly protect an area 7 fathoms and more in depth of 118 acres, and the protected 7-fathom line is only 3,190 feet in length, the total protected area of 6 fathoms and more in depth being 234 acres.

Fourth. Because a breakwater can be thoroughly constructed at Port Los Angeles 6,500 feet long, in accordance with the specifications and location adopted by the Board, including subsidence, well within the sum of money appropriated, viz, \$2,900,000. (See Appendix B.)

Fifth. That Port Los Angeles and San Pedro have always been, now are, and doubtless ever will be, mainly transshipping points and fisheries, suburban to the city of Los Angeles, which is for southern California the great focus of commerce with the world. For these reasons no large warehouses or extensive storage accommodations of any kind will be needed at Port Los Angeles or San Pedro.

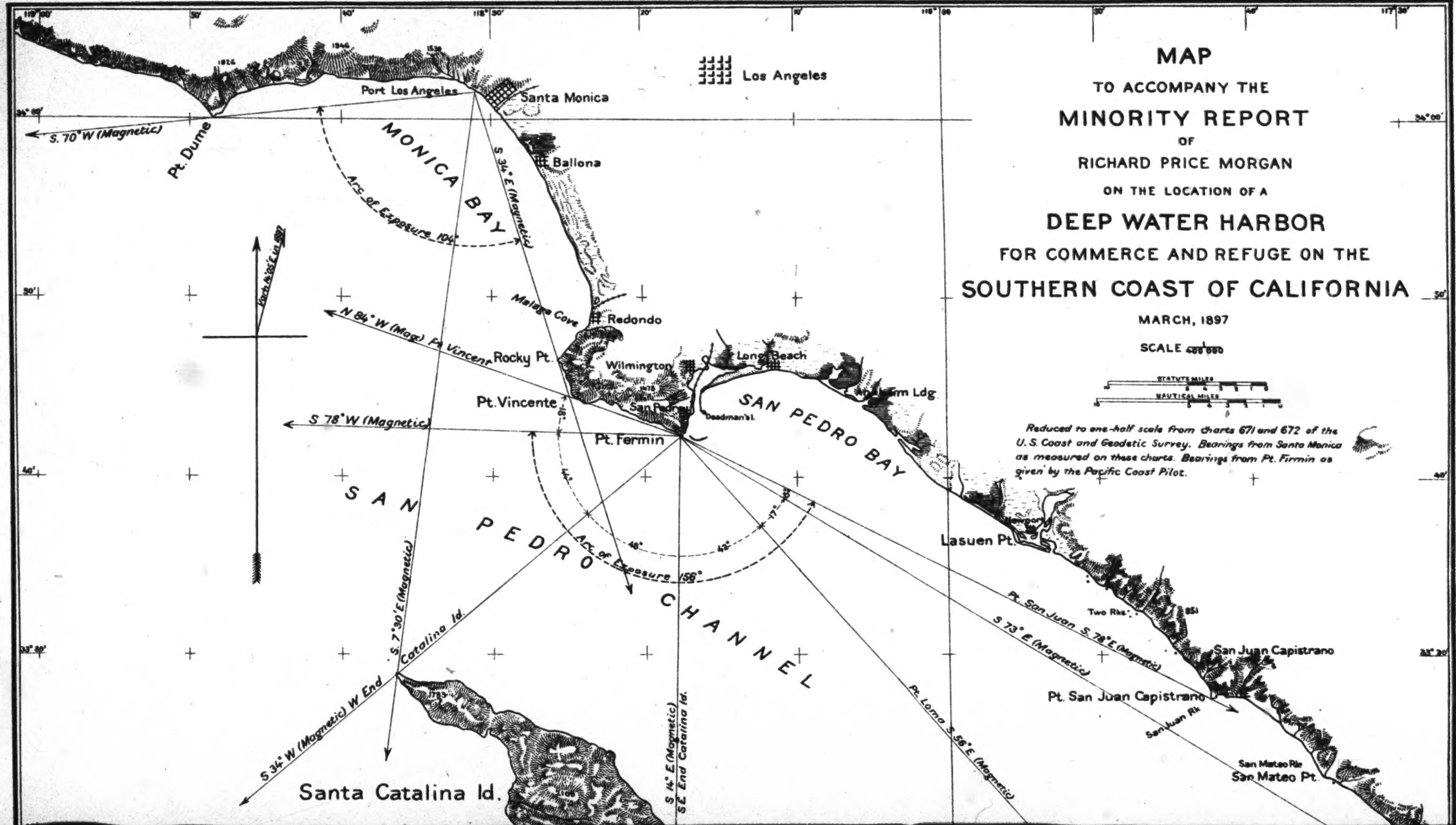
Sixth. Because the breakwater will protect a clean, continuous body of water extending to the shore, the bottom gently rising on a plane from the deep-water harbor, free from silting or deposits of any kind and of kelp.

Seventh. Because the harbor inside of 6 fathoms in depth, under the authority of the Secretary of War, will be free to all corporations or persons to develop for the purposes of commerce whenever needed, and as the subscriber understands, at their own cost, and without further cost to the Government than that of constructing and maintaining the breakwater.

The great wharf already constructed at that place by the Southern Pacific Company, a quasi-public corporation, gives guaranty of immediate connection, upon the construction of the breakwater, between land carriage and the largest vessels for commerce. The testimony before the Board shows the great cost and large capacity of this wharf, and also its great utility.

Eighth. Because the subscriber believes that the proviso of the act of Congress creating this Board and authorizing the expenditure of \$2,900,000, as follows, means what it says and that Congress has the power to enforce the conditions and defeat any monopoly of this harbor:

Provided, however, That if the Board hereby constituted, as in this section provided shall determine in favor of the construction of a breakwater at Port Los Angeles, no



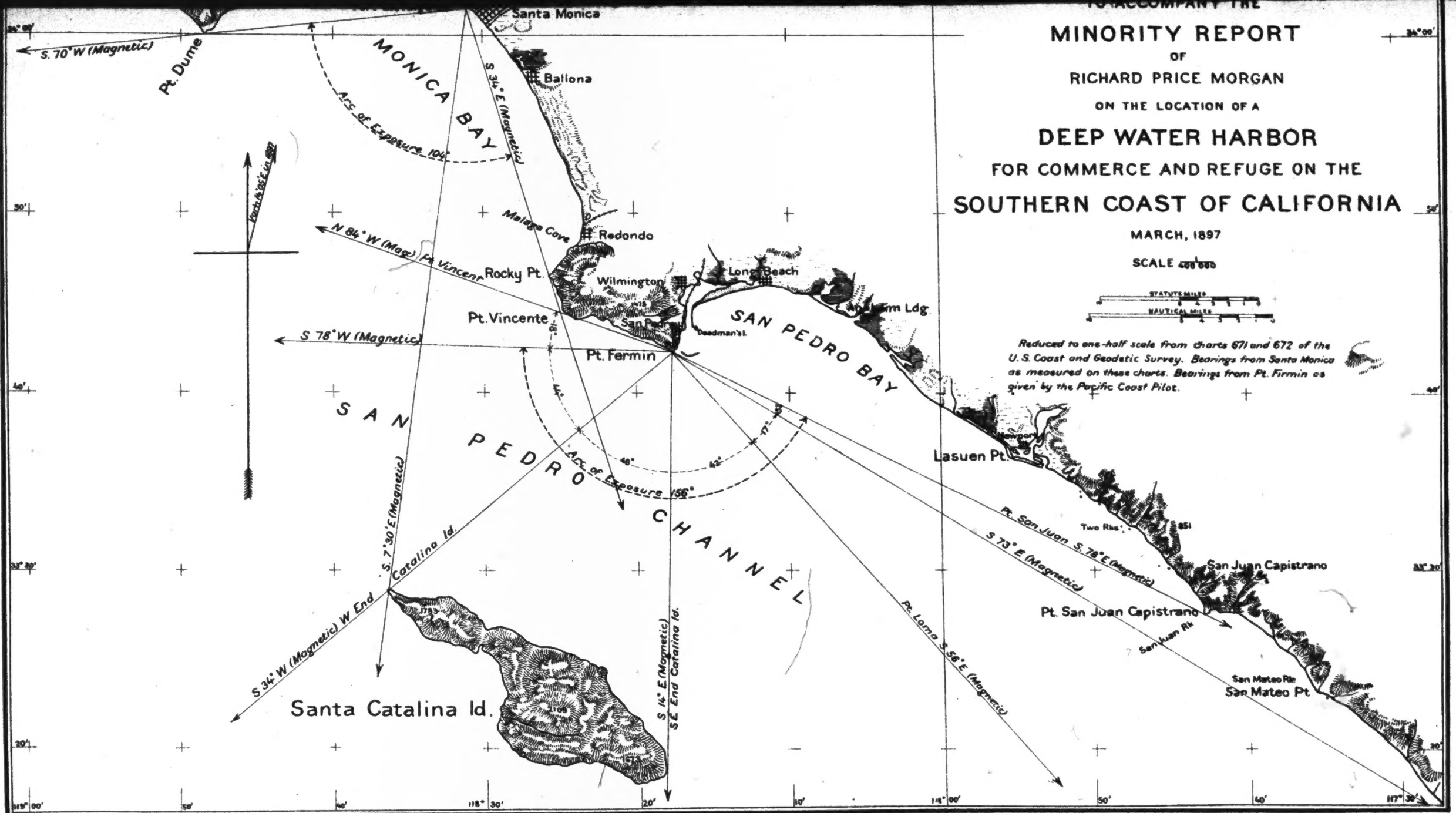
TO ACCOMPANY THE
MINORITY REPORT
 OF
 RICHARD PRICE MORGAN
 ON THE LOCATION OF A
DEEP WATER HARBOR
 FOR COMMERCE AND REFUGE ON THE
SOUTHERN COAST OF CALIFORNIA

MARCH, 1897

SCALE 400' 000



Reduced to one-half scale from charts 671 and 672 of the U. S. Coast and Geodetic Survey. Bearings from Santa Monica as measured on these charts. Bearings from Pt. Firmin as given by the Pacific Coast Pilot.



expenditure of any part of the money hereby appropriated shall be made, nor shall any contract for the construction of such breakwater be entered into, until the Southern Pacific Company, or the owner or owners thereof, shall execute an agreement and file the same with the Secretary of War that any railroad company, or any corporation engaged in the business of transportation, may share in the use of the pier now constructed at Port Los Angeles and the approaches and tracks leading thereto situate westerly of the easterly entrance to the Santa Monica tunnel, upon such just and equitable terms as may be agreed upon between the parties, and if they fail to agree, then to be determined by the Secretary of War; and before any expenditure of the money hereby appropriated is made for the construction of a breakwater at Port Los Angeles said Southern Pacific Company, or the owner of the tracks and approaches leading to said pier, shall execute an agreement and file the same with the Secretary of War, that any railroad or transportation company or corporation desiring to construct a wharf or pier in Santa Monica Bay may, for the purpose of approaching such wharf or pier, and for the purpose of constructing and operating the same, cross the track or tracks, approaches and right of way now used by the Southern Pacific Company under such regulations as may be prescribed by the Secretary of War, and upon the payment of such compensation as that officer may find to be reasonable.

Ninth. Because Port Los Angeles Harbor has about it natural features of beauty and grandeur which, added to its excellence as a deep-water harbor for commerce and of refuge, would make it famous throughout the world.

The name, Port Los Angeles, comports with city of Los Angeles, whose commercial importance mainly justifies the construction of the proposed harbor. The name San Pedro has no special significance outside of itself.

RICHARD PRICE MORGAN.

THE SECRETARY OF WAR.

APPENDIXES ACCOMPANYING MAJORITY REPORT.

APPENDIX A.

SPECIFICATIONS FOR BREAKWATER TO BE ERECTED AT SAN PEDRO, CAL.

1. The total length of the breakwater at the level of mean low water will be about 8,500 feet, but this length may be increased, if found practicable, without exceeding an aggregate cost of \$2,900,000.

2. The depth at mean low water along the site of the work varies from 24 to 52 feet.

3. The breakwater is assumed to have a cross section of the dimensions shown on the accompanying plan. It is also assumed that each cubic yard of settled enrockment in the substructure will contain 1.25 gross tons of stone, and that each cubic yard of superstructure will contain 1.75 gross tons of stone. Upon these assumptions the approximate amount of stone required for the construction of the breakwater, expressed in tons of 2,240 pounds each, is as follows:

	Tons.
Substructure	2,069,623
Superstructure.....	221,025
Total	2,290,648

4. The site of the proposed breakwater is opposite the entrance to San Pedro Harbor and immediately east of Point Firmin. The heaviest winds and seas are from southeast to southwest.

5. The working season extends through the whole year, though occasionally weather may occur during which work will be impossible. Freezing weather never occurs.

6. The work to be done consists of the construction of a substructure below the plane of mean low water and the construction of a superstructure above the plane of mean low water, this plane being the datum plane established by the United States Coast and Geodetic Survey.

7. *Substructure.*—The substructure will be formed up to the level of a plane 12 feet below mean low water by depositing stone within a width of 90 feet, of which 55 feet shall be outside of the established center line of the breakwater and 35 feet shall be inside of such established center line. The stone may be dumped from bottom-dumping barges or deposited within the prescribed limits by such other method as may be approved by the engineer officer in charge. The specified width is the estimated width on top at an elevation 12 feet below mean low water, the stone being allowed to take its natural slope below this level.

8. Between mean low water and a plane 12 feet below mean low water the stone will be deposited within a width of 38 feet, of which 19 feet shall be on each side of the established center line of the breakwater. The specified width is the estimated width on top at mean low water, the stone being allowed to take its natural slope on the harbor side of the breakwater and being roughly placed to a slope of three horizontal to one vertical on the sea side of the breakwater. The larger stones shall be placed on the sea slope. The stone may be set with derrick barges, each stone being separately raised and dropped into proper position, or handled by such other method as may be approved by the engineer officer in charge.

9. When completed and after settlement, the substructure shall have a width of 38 feet at the level of mean low water and of 90 feet at a level 12 feet below mean low water, and shall have a slope of three horizontal to one vertical on the sea side between these two elevations and such other slopes as the mass may naturally assume. Any cavities which may be found in the slopes at any time prior to the final acceptance of the finished work must be filled when so ordered by the engineer officer in charge. Before beginning the erection of the superstructure, the upper surface of the substructure shall be carefully leveled off, the cavities being filled with stone of suitable size and otherwise of the quality specified for the substructure.

10. The stone used in the substructure must be hard, durable, and not liable to disintegrate in sea water; it must weigh, when dry, at least 130 pounds per cubic foot. No stone shall weigh less than 100 pounds; not less than two-thirds of the total amount by weight contained in each load deposited must consist of stones

weighing at least 1,000 pounds each; and not less than one-third of the total amount by weight contained in each load deposited must consist of stones weighing at least 4,000 pounds each. The stones shall be of rough, irregular shape, in the form in which they come from the quarry; the least dimension shall not be less than one-quarter the greatest dimension.

11. *Superstructure.*—The superstructure will be 38 feet wide at the base and 20 feet wide on top, being 9 feet on the sea side and 11 feet on the harbor side of the established center line, and will finish at an elevation 14 feet above mean low water. It will consist of rough walls of heavy stones, the space between them being filled with stones of varying size, forming a compact mass, without large interstices. The large stones forming the walls must be laid with their longest dimensions perpendicular to the axis of the breakwater, unless otherwise directed by the engineer officer in charge, the face of each wall being stepped and not battered. The general character of the structure is shown on the accompanying sketch.

12. The stone used in the superstructure must be hard, durable, and not liable to disintegrate in sea water; it must weigh, when dry, at least 160 pounds per cubic foot. The stones used in constructing the wall on the sea side must weigh not less than 16,000 pounds each. The stones used in the wall on the harbor side must weigh not less than 6,000 pounds each. The stones in both walls must be roughly rectangular in shape, so as to form a reasonably compact structure, with rough steps approximating in shape those shown on the accompanying sketch. The stones used for filling between the walls must be of the same quality, but of such sizes and shapes as may be approved by the engineer officer in charge. All openings in the top surface must be filled.

13. Each end of the superstructure will be formed of a single block of concrete 40 feet square and 20 feet high; the center of this block is to be on the established center line of the breakwater, and the bottom of the block is to be 3 feet below and the top 17 feet above the plane of mean low water. The concrete shall be formed of broken stone, sand, and Portland cement, in the proportions of six parts of stone, three parts of sand, and one of cement by volume. A wooden mold shall be constructed on the substructure, in which the concrete block shall be made; this mold shall consist of sides only; the stone of the substructure shall be covered with gunny cloth or other suitable textile material loosely placed, and form the bottom. The construction of each block shall proceed continuously, without interruption, until the whole mass is placed. The engineer officer in charge may authorize the substitution of gravel in place of broken stone and sand, and may prescribe such rules as he may deem advisable for the inspection and manipulation of the materials used in the concrete, and may increase proportion of cement in work under water.

14. *Payments.*—The stone for both substructure and superstructure will be measured and paid for in tons of 2,240 pounds. The concrete in the superstructure will be paid for by the cubic yard. No material will be paid for which is not part of the permanent structure.

15. The weight of all substructure stone received by water will be determined by the displacement of the vessel in which it is received.

16. All stone received by cars shall be weighed upon the cars upon which it is received. Each large stone intended for use in constructing the walls of the superstructure shall be weighed singly at the point of shipment, after having marked on it in at least two places, plainly and permanently with paint numbers, indicating the serial number of the stone. The contractor shall furnish at his own expense all necessary facilities and labor for weighing such cars and stones.

17. The vessels in which the stone is received shall be weighed and marked by legally sworn weighers when first used. Sworn certificates and detailed description of the marks shall be furnished by the weigher at the expense of the contractor. Any vessel shall be reweighed whenever required by the engineer officer in charge, and in case of disagreement as to weights or measurements, his decision shall be final.

18. *Supervision.*—Stone, in matters of quality, size, weight, marking, depositing, and handling, shall at all times be subject to the inspection and approval of the engineer officer in charge or his agents, and the work shall be conducted in strict accordance with the instructions given by him or them from time to time. No material will be paid for which has not been accepted and deposited in accordance with these specifications.

19. The precise location of the work will be fixed by the engineer in charge or his agents; the line will be marked by ranges, pipes, stakes, or other suitable methods at the expense of the United States, but in case these marks are removed or destroyed, the contractor must furnish any assistance in his power in replacing them without charge to the United States.

20. The vessels from which stone is deposited in the substructure must be moored in position under the direction of the engineer officer in charge or his agents before depositing is commenced. The buoys or other appliances for mooring must be established and maintained by the contractor.

21. During the progress of the work the contractor must keep suitable lights from sunset to sunrise upon all his vessels anchored at or in the vicinity of the work; he

must maintain on the work, at his own expense, such lights as the engineer officer in charge may direct. The United States will not be responsible for any accident which may occur to the contractor's plant, to passing vessels, or to any property whatever during the progress of the work.

22. *Order of work.*—The work will be begun by the construction of the substructure at the west end of the breakwater, where the stone will be raised to the level of mean low water as rapidly as possible, and the substructure will then be continued along the line of the breakwater until the east end is reached.

23. No portion of the superstructure will be erected until the substructure on which it is placed has been completed at least six months, and any settlement must be corrected by leveling up the substructure before beginning work on the superstructure. In general the superstructure will be built in the same order as the substructure, but the concrete blocks shall be completed before the rock superstructure immediately adjacent to them is put in.

24. The engineer officer in charge shall have the right to order additional stone to be placed in any such position as may, in his judgment, be expedient to provide for settlement or to strengthen the work against special local exposure.

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

WASHINGTON, D. C., March 1, 1897.

APPENDIX B.

ESTIMATE OF COST OF BREAKWATER.

The breakwater is 8,500 feet long at level of mean low water. Station 0 is the west end of the breakwater; station 85 is at east end. The alignment of the breakwater is as follows: From station 0 to station 30, on a magnetic course, south 72° east; station 30 is the point of curve of a 3° curve (1,910 feet radius) 1,800 feet long, the tangent point being at station 48; from station 48 to station 85, on a magnetic course, north 54° east. Stations are 100 feet apart. The substructure is 8,500 feet long at mean low water and 8,532 feet long in a plane 12 feet below mean low water, the difference representing the end slopes in this 12 feet.

Depths have been taken at the points given in the tables below and quantities figured on the basis given in that table.

Station.	Depth below mean low water.	Length of prism.	Cubic yards.
	<i>Feet.</i>		
		West slope.	384
0	24	441	20,606
8 + 50	30	635	47,250
12 + 50	36	625	67,331
26	42	950	136,163
26 + 50	48	925	168,720
39 + 50	51)	1,900	386,137
44 + 50	51)		
64 + 50	48	1,500	273,600
74 + 50	50)	1,566	307,234
85	50)		
		East slope.	5,419
			1,412,934

This estimate is made on the basis of averaging end areas and gives results slightly too large. A second estimate made on the basis of middle areas gives 1,397,932 cubic yards, this method giving results which are slightly too small. As a further check the volume of the breakwater was divided into two prismoids and one prism, the divisions being placed at station 18 in a depth of 40 feet and at station 35 in a depth of 50 feet and its volume calculated by the prismoidal formula, the result being 1,412,640 cubic yards; this is also slightly in excess, as no allowance is made for the shoaling to 48 feet at station 65. The first of these three quantities has been taken as the basis of the estimates.

Between the plane of rest and mean low water there are 28.5 cubic yards per linear foot of breakwater, while there are 257 cubic yards at each end in the slope between mean low water and the plane of rest. The number of cubic yards in the substructure above the plane of rest will therefore be $8,500 \times 28.5 + 2 \times 257 = 242,764$ cubic yards.

The stone superstructure contains 15 cubic yards per linear foot of breakwater and is 80 feet shorter than the substructure, the difference being the length of the two concrete blocks. Its contents are therefore $8,420 \times 15 = 126,300$ cubic yards.

Each concrete block is 40 feet square and 20 feet high; the volume in the two concrete blocks is $2 \times 40 \times 40 \times 20 = 64,000$ cubic feet.

The estimated cost of the breakwater is then as follows:

1,412,934 cubic yards substructure below plane of rest, at \$1.25.....	\$1,766,167
242,764 cubic yards substructure above plane of rest, at \$1.50.....	364,146
126,300 cubic yards superstructure, at \$3.....	378,900
64,000 cubic feet of concrete, at 22 cents.....	14,080
	2,523,293
Add for engineering, contingencies, etc., 15 per cent.....	378,494
Total.....	2,901,787

J. G. WALKER,

Rear-Admiral, U. S. N., Chairman.

WASHINGTON, D. C., March 1, 1897.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY,

Washington, D. C., March 26, 1897.

SIR: With letter of the 8th instant I had the honor, under a call from the Senate of the United States, to submit to you copy of report of March 1, 1897, by the Board constituted under the provisions of the river and harbor act of June 3, 1896, to determine location "for a deep-water harbor for commerce and of refuge at Port Los Angeles, in Santa Monica Bay, California, or at San Pedro, in said State."

Of the appendices to accompany the report of the Board, only two had been received at that time, and the absence of the missing papers and of two additional maps was explained in Admiral Walker's letter of March 1, a copy of which accompanied the report.

The additional appendices and maps have just reached this office, and I have the honor to submit them as follows, with recommendation that they accompany the copy of the report of the Board submitted from this office on the 8th instant, viz:

Appendix C. Report of Smithsonian Institution on stone.

Appendix D. Report of Randell Hunt on borings at San Pedro.

Appendix E. Reports of E. Gerber and Randell Hunt on borings in Santa Monica Bay.

Appendix F. Stenographic report of testimony at public hearings in Los Angeles, Cal., accompanied by special exhibits filed with the Board during said hearings.

Appendix G. Tonnage of the ports of Port Los Angeles and San Pedro.

Chart of Port Los Angeles and Santa Monica Bay.

Chart of San Pedro Inner Harbor.

No copies of these papers have been retained in this office.

Very respectfully, your obedient servant,

JOHN M. WILSON,

Brig. Gen., Chief of Engineers, U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

S. Doc. 18—3

LETTER OF REAR-ADMIRAL J. G. WALKER, U. S. N.
 BOARD FOR LOCATING A DEEP-WATER HARBOR
 IN SOUTHERN CALIFORNIA,
Washington, D. C., March 18, 1897.

SIR: I have the honor to transmit to you herewith the following appendixes to the report of this Board dated March 1, 1897, viz:

Appendix C.—Report of Smithsonian Institution on stone.

Appendix D.—Report of Randell Hunt on borings at San Pedro.

Appendix E.—Reports of E. Gerber and Randell Hunt on borings in Santa Monica Bay.

Appendix F.—Stenographic report of testimony at public hearings in Los Angeles, Cal., accompanied by special exhibits filed with the Board during said hearings.

Appendix G.—Tonnage of the ports of Port Los Angeles and San Pedro.

There are also transmitted herewith the following charts and profiles, reference to which is made in the above-mentioned report, viz:

Chart of Port Los Angeles and Santa Monica Bay.

Chart of San Pedro inner harbor.

Map and profile accompanying Hunt's report of San Pedro borings; Appendix D.

Map and profile accompanying Hunt's first report on Santa Monica borings; Appendix E.

Very respectfully,

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

The SECRETARY OF WAR.

APPENDIX C.

REPORT ON SPECIMENS OF STONE FROM QUARRIES IN SOUTHERN CALIFORNIA.

SMITHSONIAN INSTITUTION,
Washington, D. C., February 13, 1897.

DEAR SIR: In further reference to your letter of January 21, I take great pleasure in forwarding herewith a report by Dr. George P. Merrill, curator of the department of geology in the National Museum, on the specimens of stone submitted for examination. The tests are as full and complete as it has been possible to make them with the time and facilities at command.

Yours, very respectfully,

S. P. LANGLEY, *Secretary.*

Rear-Admiral JOHN G. WALKER, U. S. N.,
Chairman Deep-Water Harbor Board, Navy Department.

The material classed as granites from the Casa Blanca and S. P. Declez quarry are rocks of an intermediate type between the true granites and the diorites and which have been classed as grano-diorites by geologists working in these regions. They consist essentially of quartz, both potash and soda-lime feldspars, hornblende, and black mica. The structure is essentially that of the granites proper. So far as can be determined from the samples submitted, they contain no constituents such as will render them liable to more rapid degeneration than is characteristic of rocks of this group and structure.

The so-called Catalina porphyry is a volcanic rock, a lava of comparatively recent geological age, and is to be classified as a rhyolite. There are available only theoretical data for estimating the suitability of rocks of this type for general structural purposes. They are a trifle more absorptive than the grano-diorites, but contain no constituents liable to rapid decomposition. Stones of this type have thus far been too little used to give us any practical illustrations of their enduring qualities. The sandstones are composed essentially of angular granules of quartz and siliceous minerals cemented quite largely by calcite. This cementing constituent, aside from possessing little strength of its own, is liable to removal by solution, causing the stone to disintegrate.

In the accompanying table are given the specific gravities, the weight per cubic foot as calculated from these specific gravities, and the percentage by weight of water absorbed. Concerning this table it should be stated that the ratio of absorption as given is a trifle high, owing to the fact that the tests were made on rough, angular pieces. Certain discrepancies which the table shows may probably be accounted for on the supposition that some of these fragments were more ragged than others, and perhaps contain minute rifts due to the manner in which the piece was obtained. The weight per cubic foot as given for the sandstones is in reality too high, since it represents the weight of the stones with the air pumped from its pores. Experiments made by first coating the fragments with paraffine to exclude the air

yielded specific gravities of but 2.34, or a weight per cubic foot of 146.25 pounds as against 162 pounds by the other method.

There is not sufficient time for other tests, nor have we proper facilities for making them, but from the facts given above, coupled with experience, I am led to state that the sandstone is liable to serious disintegration on exposure. The Catalina porphyry is preferable, and would very probably meet all the requirements. The best of the samples submitted are those from the Casa Blanca quarries, and No. 3 from the Decies quarry.

	Number.	Specific gravity.	Weight per cubic foot.	Absorption by weight.
			<i>Pounds.</i>	<i>Per cent.</i>
Casa Blanca granite	1	2.72	170	0.14
Do.....	2	2.72	170	.87
S. P. Decies quarry	1	2.80	175	.21
Do.....	2	2.80	175	.87
Do.....	3	2.78	173.75	.22
Catalina porphyry.....	1	2.37	148.125	1.77
Do.....	2	2.29	143.125	.43
Do.....	3	2.39	149.37	1.08
S. P. Chataworth sandstone.....	1	2.50	161.188	4.50
Do.....	2	2.60	162.50	4.51
Commercial Chataworth sandstone.....	.....	2.7	168.75	4.77

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

APPENDIX D.

REPORT OF RANDELL HUNT ON BORINGS AT SAN PEDRO, CAL.

SAN FRANCISCO, CAL., February 9, 1897.

DEAR SIR: In accordance with your instructions I submit herewith the following report on the borings made at San Pedro Harbor in January, 1897, under the directions of your Board:

The location of the borings is very carefully given on the map which is submitted with this report.

It was the general intention in making the borings that they should be carried to a nearly uniform depth of 36 feet below the mean of the lower low waters, excepting in the case of those made in deep water, as on the line of the proposed breakwater.

A long line of borings was made, extending from opposite the northern end of the wharves in the inner harbor along the channel out through the jetties, and thence in a southeasterly course to a depth of water of 31 feet.

This line of borings has been plotted in a profile which is herewith submitted.

Reference to the map and profile shows that the character of the borings from No. 35 to No. 19 (a distance of 7,500 feet) is of uniform material in all cases (excepting at the lower depth of boring No. 28), and consists of a fine gray sand.

At No. 19 the character of the material changes, and, extending southeast for a distance of about 2,500 feet, the borings are in a stiff black clay, excepting a few feet of gravel and sand forming a top layer in some cases.

From near No. 9 to No. 18 this black clay is found at a greater depth and the deposit of gravel and sand increases on the top.

No rock.—On this entire profile of borings, $2\frac{1}{2}$ miles long, no rock, beyond a few boulders, was found.

The boulders found in the vicinity of boring No. 7 were at first thought to indicate solid rock, but a large number of borings, besides the actual drilling through one of the boulders, shows conclusively that the deposit at this point is only of some pieces of "float" rock.

Bell-buoy rock.—While there is no rock on the line of borings indicated by the profile, there is a well-defined rock near the bell buoy. This rock is described in the table of borings forming part of this report. It is 200 feet in diameter, with depths of water over it from 17 to 25 feet.

Borings on the line of the proposed breakwater.—Six borings were made on the line of the proposed breakwater at locations shown on the accompanying map and also on the separate profile herewith submitted. The instructions in regard to these borings were "intended to determine whether there is any mud which is likely to settle enough under the weight of the breakwater to cause serious trouble."

It was not thought necessary to carry these borings to greater depths than shown on the profile, for they generally indicated a firm and good material in all respects. There is no soft mud shown by these borings, and no settlement of a breakwater is likely to occur if built on this foundation.

Examination of "rocky" bottom.—An examination was made of the "rocky" bottom reported by Lieutenant Osborn in $4\frac{1}{2}$ fathoms and about 3,500 feet southeast of the west jetty; also of the "rocky" bottom reported in 6 $\frac{1}{2}$ fathoms about southwest from the end of the west jetty. These examinations are marked as

borings on the accompanying map and are numbered 49 and 50 there and in the annexed detailed tabulation of borings.

At both locations only an occasional boulder could be found, and the borings indicate no other rock.

Between the jetties near their mouth three additional borings were made, viz, Nos. 36, 37, and 53, with the special purpose of investigating the reported existence of rock at moderate depths at these locations. The same formation of stiff black clay underlying a few feet of sand and gravel was found at Nos. 36 and 53 which exists throughout the locality, but with an occasional boulder in it. At No. 37 rock was encountered from 25 to 29 feet in depth. A study, however, of the various surrounding borings clearly indicates that this "rock" is a piece of "float" or a boulder.

The annexed table of borings gives the full details of each as made.

Respectfully submitted,

RADELL HUNT, *Assistant Engineer.*

Admiral JOHN G. WALKER,

Chairman of Board for Locating a Deep-Water Harbor in Southern California.

BORINGS.

Number of boring.	Depth of water below mean lower low water.	Total depth of boring below mean lower low water.	Description of borings.
	<i>Feet.</i>	<i>Feet.</i>	
2	16½	35	16½ to 17 feet. Several small stones.
3	18	36	17 to 35 feet. Stiff black clay.
4	16	35	18 to 36 feet. Stiff black clay.
5	14	31	16 to 16½ feet. Gravel and stones.
6	16	41	17 to 35 feet. Stiff black clay.
7a	15	39	14 to 15 feet. Gravel and stones from 1 to 3 inches diameter.
7b			15 to 31 feet. Stiff black clay.
7c			16 to 18 feet. Sand.
7d			18 to 20 feet. Small stones, 2 to 3 inches diameter.
7e			20 to 23 feet. Sand.
7f			23 to 41 feet. Stiff black clay.
7g			15 to 20 feet. Sand.
7h			20 to 21 feet. Black clay.
7i			21 feet to 28 feet 9 inches. Sand and gravel.
8			28 feet 9 inches to 30½ feet. Rock, soft; drilled through easily.
9	25	36	30½ to 39 feet. Black clay, moderately hard.
10	22	36	25 feet 4 inches. Rock boulder.
11	24	37	29 feet 5 inches. Rock boulder.
12	18½	38	28 feet 3 inches. Rock boulder.
13	19	36	28 feet. Rock boulder.
14	17	38	34 feet. Hard sand.
15	16	40	34 feet. Hard, sandy clay.
16	16	36	31 feet. Rock boulder.
17	28	38	37 feet. Clay; a few feet north of 7a.
18	31	43	29 feet. Rock boulder.
19	16	36	10 feet 8 inches to 23 feet. Sand.
20			23 to 24 feet. Stone.
21	17½	34½	24 to 36 feet. Sand and stiff clay.
22	16½	34	25 to 30 feet. Sand and gravel.
			30 to 32 feet. Stiff clay; 33 feet, struck "cobble," sand, and clay.
			33 to 36 feet. Stiff clay.
			22 to 30 feet. Sand; small stones on top.
			30 to 35 feet. Sand and gravel with clay strata.
			35 to 36 feet. Stiff black clay.
			24 to 29 feet. Gravel and sand; small stones on top.
			29 to 31 feet. Gravel and clay.
			31 to 37 feet. Clay.
			18½ to 38 feet. Fine gray sand; rod went down quickly to full depth as soon as jet was applied, and could be shoved down farther by hand when jet ceased.
			19 to 36 feet. Fine gray sand; similar to No. 12.
			37 to 38 feet. Fine gray sand; similar to No. 12.
			16 to 40 feet. Fine gray sand; similar to No. 12.
			16 to 36 feet. Fine gray sand; similar to No. 12.
			28 to 35 feet. Coarse sand and gravel and some stiff mud.
			35 to 38 feet. Clay.
			31 to 43 feet. Clay; black.
			16 to 29 feet. Sand and some clay, fairly hard; some gravel.
			29 to 36 feet. Sand and clay, very hard.
			(Same as boring No. 7.)
			18 to 22 feet. Gravel and sand; some mud.
			22 to 28 feet. Hard clay, sand, and gravel.
			30 to 34 feet. Extra hard black clay.
			17 to 22 feet. Gravel and sand.
			22 to 28 feet. Hard clay mixed with sand and gravel.
			28 to 34 feet. Extra hard black clay.

* See Nos. 20, 25, 26, and 27 for additional borings around No. 7.

DEEP-WATER HARBOR.

37

BORINGS—Continued.

Num- ber of boring.	Depth of water be- low mean lower water.	Total depth of boring below mean lower low water.	Description of borings.
	<i>Feet.</i>	<i>Feet.</i>	
23	15	34½	15 to 16 feet. Sand. 16 to 18 feet. Stones. 18 to 29 feet. Gravel and sand. 29 to 34½ feet. Extra hard black clay.
24	15	34½	Ditto to No. 23. At 29-foot depth struck boulder; moved a few feet and passed by it.
25	13½	25	14 to 35 feet. Sand and gravel and some clay strata, but not very hard; no hard clay strata as in Nos. 22, 23, and 24.
26	14½	34	Similar to No. 25. A layer of stones 2 feet thick under the first few feet of sand and gravel.
27	13½	35	Similar to Nos. 25 and 26.
28	17	30	17 to 26 feet. Sand. 26 to 30 feet. Sand and clay medium hard. 30 to 36 feet. Very hard indeed.
29	20	40	20 to 40 feet. Sand and some mud; very soft.
30	20	40	20 to 40 feet. Sand and some mud; all soft all the way down.
31	18	39	18 to 39 feet. Mud and sand on top and pure sand the last half of boring; all soft.
32	15	38	18 to 25 feet. Mud and sand. 25 to 38 feet. Sand; very soft.
33	21	38	21 to 28 feet. Mud and fine sand. 28 to 38 feet. Sand; very soft.
34	17	38	17 to 30 feet. Mud and sand. 30 to 38 feet. Fine sand with a little gravel; very soft.
35	11½	39	11½ to 39 feet. Fine sand and some mud; very soft.
36	17	33	17 to 21 feet. Sand and gravel. 21 to 23 feet. Stones 2 inches to 3 inches diameter. 23½ feet. Struck boulder; moved rod a few feet and in hard clay. 33 feet. Hard clay.
37	16½	29	16½ to 29 feet. Gravel. 20 to 27 feet. Gravel and clay. 25, 27, and 29 feet. Rock. At locations within a few feet of each other.
38	-----	35	34 feet. Boulder. 35 feet. Clay alongside boulder.
39	-----	-----	-----
40	29	44	29 to 40 feet. Sand. 40 to 44 feet. Sand and clay.
41	27½	44	27½ to 40 feet. Sand. 40 to 44 feet. Sand and clay.
42	-----	-----	Examination of rock near bell buoy: The rock near the bell buoy is about 200 feet in diameter, mostly clear of any deposit, except a few inches of gravel. The depth of water over the rock is generally about 22 to 25 feet, but it rises to 20 feet, with a number of projections, which in a few cases have only 17 feet of water over them. An attempt to drill into the rock was not successful, the rock being hard and the drill not suitable. A heavy growth of "kelp" very well defines the limits of the rock.

BORINGS ON LINE OF PROPOSED BREAKWATER.

43	50	55	50 to 55 feet. Gravel; boulder on top. 55 feet. Clay; stiff.
44	48	53	48 to 53 feet. Gravel and sand, with some clay; small boulder on surface. 53 to 55 feet. Stiff mud.
45	25	34	25½ to 33 feet. Gravel and clay. 33 to 34 feet. Clay; moderately hard. (See sample.)
46	33	37	33 to 34 feet. Stiff mud or clay. 34 to 37 feet. Gravel and clay; hard.
47	45	48	45 to 48 feet. Gravel and clay; moderately hard. 48 to 51 feet. Stiff mud or clay.
48	50	55	51 to 55 feet. Gravel and clay mixed. 42 to 43 feet. Gravel and some clay.
49	39	46	43 feet. Struck boulder; moved rod 5 feet. 43 to 45 feet. Clay.
50	28	36	28 to 36 feet. Gravel and clay; struck boulder near top. 6 to 10 feet. Sand.
51	6	38	10 to 15 feet. Sand and mud. 15 to 38 feet. Clay.
52	10	36	10 to 36 feet. Light sand. 14 to 18 feet. Sand; at 18 feet struck rock or boulder; moved rod 2 feet.
53	14	32	18 to 20 feet. Gravel. 20 to 32 feet. Hard black clay.

RADELL HUNT,
Assistant Engineer.

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

DEEP-WATER HARBOR.

APPENDIX E.

REPORTS OF E. GERBER AND RANDELL HUNT ON BORINGS IN SANTA MONICA BAY.

REPORT OF RANDELL HUNT.

SAN FRANCISCO, CAL., *February 9, 1897.*

DEAR SIR: Under instructions from the Board, a series of borings was made at Santa Monica Harbor as herewith reported.

The location and depths of the borings are indicated in the accompanying map and profile, and the detail character of each boring is given in full in the annexed table.

There is a very great similarity to all the borings at Santa Monica, the material bored through being very nearly the same in most of its characteristics. This consisted of a very fine sand, into which the boring pipe penetrated with the greatest ease as soon as the water jet was applied.

A little mud appeared mixed with the sand in one or two borings, near the surface, and in boring No. 6 a little fine gravel mixed with the sand was found at the last few feet of depth. The character of all these borings would indicate a settlement of a breakwater built upon such material.

How much this would be I am unable to say, but it would undoubtedly be several feet.

Respectfully submitted.

RANDELL HUNT,
Assistant Engineer.

Admiral JOHN G. WALKER,
*Chairman of the Board for Locating
a Deep-Water Harbor in Southern California.*

Borings at Santa Monica Harbor, January, 1897.

Number of boring.	Depth of water below mean lower low water.	Total depth of boring below mean lower low water.	Description of borings.
	<i>Feet.</i>	<i>Feet.</i>	
1	54	64	54 to 64 feet. Loose gray-green sand, extremely fine grained; rod sunk easily by hand.
2	46	54	46 to 54 feet. Yellowish gray sand, very fine; rod easily put down without jet.
3	50	60	50 to 60 feet. Green-gray sand, very fine, very soft; rod put down with jet.
4	51	61	51 to 52 feet. A little mud in first foot; harder on top than Nos. 1 and 3, but soft.
5	53	63	52 to 61 feet. Very fine, soft sand; rod down easily with jet. 53 to 63 feet. Green-gray sand, very fine, soft; a little mud in top foot. (Sample from fluke of anchor.)
6	53	63	53 to 60 feet. Gray-green sand, fine and soft.
7	54	64	60 to 63 feet. A little fine gravel mixed with sand; rod sank easily with jet; soft. 54 to 64 feet. Green-gray sand, very fine grained, and soft.

See profile.

RANDELL HUNT, *Assistant Engineer.*

REPORT OF E. GERBER.

CHICAGO, *March 9, 1897.*

DEAR SIR: In accordance with your instructions of February 10 and 11 to proceed to Los Angeles as the representative of your Board to have personal knowledge of additional borings to be made at Port Los Angeles in Santa Monica Bay, I left Chicago on the evening of February 13 and arrived at Los Angeles on the evening

of the 16th. I there met Mr. Randell Hunt, who was in charge of the boring party, and we proceeded together on the following day to Santa Monica, and at once began the borings. Fog, rain, and storm on the 17th, 18th, 19th, and 20th made it impossible to prosecute the work as rapidly as desired, and only one boring was made in those four days; after that, however, the weather improving, the work went on with more satisfaction.

According to original instructions, these borings were to be made at intervals of approximately 1,000 feet along the proposed breakwater line and also on several lines nearer shore, viz, the 7, 8, and 5 fathom lines. They were to be made to a depth of 20 feet below the bottom unless hard bottom was struck before reaching that depth, samples of each boring to be preserved as completely as practicable, and thoroughness in work being especially enjoined.

These instructions were subsequently modified to embrace additional borings along the breakwater line at points as nearly as practicable in the middle of each space between the original borings, and those on all inner lines except the 7-fathom line were omitted. The additional borings were designated as plus, and requirement of samples from these and from the inner borings was dropped, though they were generally obtained.

The appliances used in making these borings were the same that were used at San Pedro Bay by Mr. Hunt, and consisted of a tug, a lighter on which there was a small steam pump operated by a small single-cylinder hoisting engine, and the necessary pipes and fittings. From the lighter was sunk a gas pipe by means of a water jet to required depth.

In the borings of the first two days, February 17 and 21, a 1-inch pipe reduced to three-fourths inch for 12 feet near the bottom was used, and for purposes of obtaining samples a sand pump of 1½-inch pipe 4 feet long, with valves at the top and bottom, lashed to lower end of jet pipe, was employed. In the heavy swell of these days the 1-inch pipe proved inadequate in stiffness and the ½-inch pipe was broken off entirely. On the 21st, while using 1-inch pipe throughout, it also broke.

A 4-inch casing was next tried with the jet working inside; this, however, was used in only one instance, while waiting for a new sand pump to be provided, and was abandoned as soon as the other appliances arrived, principally because it was too heavy and tedious to operate.

The most successful device used consisted of 80 feet of 1½-inch pipe, fitted at the lower end with a reducer from 1½ to 1 inch, and a 1-inch nipple about 6 inches long. This pipe was used as a jet in penetrating the ground, and when it was desired to obtain a sample at any depth the water hose was disconnected, a marble 1½ inches in diameter dropped into the pipe, which with the reducer formed a valve, and thus a sand pump was made of the whole length of pipe. This device worked admirably as a jet in penetrating the bottom, and as a sand pump was admirable in obtaining sand samples. To obtain samples in clay, it was only necessary to jet the pipe to the clay, then drive it for a short distance by means of a maul, when a plug of clay would fill up the nipple, which plug could then be brought up without difficulty, the valve preventing the water from forcing the plug out. With this contrivance all of the borings after February 22 were made. The pipe was amply stiff and the device for obtaining samples worked with certainty.

The location of borings was made by Mr. Hunt. A copy of a chart recently made by the United States Coast Survey was procured, the location of borings transferred from blue print furnished by the Board to this chart, and connected with stations established by the Coast Survey. In the field the location was made from three stations by means of a sextant.

The work at Santa Monica Bay was carried out on the basis of original number of borings till instructed by the Board on the 25th of February to close up the work there on that day and make two additional borings at San Pedro. The tug, with lighter and men, was sent around from Port Los Angeles to San Pedro on the night of the 25th, and they were ready to make the two borings there the next day.

In the table below are given the materials found at the different points, the location of borings being given on the accompanying map. Each boring is described more in detail below the table.

DEEP-WATER HARBOR.

Borings at Santa Monica Bay.

BORINGS ON LINE OF PROPOSED BREAKWATER.

Designation of boring.	Date.	Material penetrated.	Number of feet.	Elevation of bottom.	Time of penetration.	Samples.
<i>a</i>	Feb. 24	Water	49.5	-49.5	m. s.	No. XXVII.—From elevation —52, fine sand. No. XXVIII.—Elevation —56.5, a little coarser sand. No. XXVIII.—Elevation —57, coarse sand and gravel. No. XXX.—Elevation —61, hard, yellow sandy clay; plug in pipe. No. XXXI.—Elevation —60, hard, pure, black clay; plug in pipe.
		Fine sand	7	-50.5	.....	No. XXV.—Elevation —59, fine sand. No. XXVI.—Elevation —59, medium stiff clay from outside of reducer.
		Very coarse sand and fine gravel.	1	-57.5	0 30	No. XXI.—Elevation —53, fine sand, with broken shells. No. XXI.—Elevation —59, fine sand. No. XXIII.—Elevation —60, medium stiff clay from outside of reducer. No. XXIV.—Elevation —71, fine sand, a little coarser than above. No. XX.—Elevation —63.5, stiff, blue clay; plug in pipe.
		Hard yellow clay to hard black clay.	11.5	-60	6 30	No. XVII.—Elevation —50, fine sand. No. XVIII.—Elevation —60, fine sand. No. XIX.—Elevation —67, stiff, pure, blue clay; plug in pipe. No. XVI.—Elevation —50, clay from outside of reducer. Very coarse sand in sand pump.
<i>a+</i>	Feb. 24	Water	49.4	-49.4	.....	No. XII.—Elevation —50, fine sand. No. XIII.—Elevation —59, fine sand, with shells. No. XIV.—Elevation —67, clay, hard, greenish blue, from outside of reducer. No. XV.—Elevation —74, medium greenish clean sand.
		Fine sand	9.6	-50	25	No. X.—Elevation —50, fine sand, with some mud, from fluke of anchor. No. XI.—Elevation —71, medium sand.
		Clay	1	-60	2 25	No. VII.—Elevation —53, fine sand. No. VIII.—Elevation —65, fine sand. No. IX.—Elevation —77, sand a little coarser than above.
<i>β</i>	Feb. 24	Water	48.5	-48.5	.....	No. I.—Elevation —49, fine sand; sand with some shells.
		Fine sand; shells near surface.	11.5	-60	10	No. III.—Elevation —52, fine sand. No. IV.—Elevation —56, fine sand. No. V.—Elevation —67, hard, greenish-blue clay; plug in pipe.
		Medium stiff clay.	5	-65	3 40	
		Fine sand; a little coarser than above.	6	-71	4 10	
<i>β+</i>	Feb. 24	Water	48	-48	.....	
		Fine sand	13.5	-61.5	30	
		Clay	2	-63.5	.....	
<i>γ</i>	Feb. 24	Water	47	-47	.....	
		Fine sand	13	-60	30	
		Clay	7	-67	6 30	
<i>γ+</i>	Feb. 23	Water	50	-50	.....	
		Fine sand	15	-65	45	
		Stiff light clay.	5	-70	3 45	
		Very coarse sand.	.....	-70	.....	
<i>δ</i>	Feb. 23	Water	49	-49	.....	
		Fine sand	17.5	-66.5	1 0	
		Stiff clay	1.5	-68	.....	
		Medium sand	6	-74	.....	
<i>δ+</i>	Feb. 23	Water	50	-50	.....	
		Fine sand, becoming a little coarser near bottom of boring.	21	-71	32	
<i>ε</i>	Feb. 23	Water	50	-50	.....	
		Fine sand	15	-65	1 10	
		Medium sand .....	.....	-77	.....	
<i>ε+</i>	Feb. 17	Water	49	-49	.....	
		Fine sand	15	-64	.....	
		Boulder .....	.....	-64	.....	
		Fine gravel	1	-65	.....	
		Sand	8	-73	.....	
	Feb. 21	Water	47	-47	.....	
		Fine sand; clean and firm on top, but softer below surface, with increasing amount of mud.	20	-67	.....	
		Hard greenish blue clay.	.....	-67	.....	
<i>ζ+</i>	Feb. 22	Water	45	-45	.....	No samples.
		Fine sand	4	-49	.....	
		Thin layer gravel.	.....	-60	.....	
		Fine sand	20	-60	.....	
<i>η</i>	Feb. 22	Water	42	-42	.....	No. VI.—Elevation —50, fine sand overflow from casing.
		Fine sand	20	-62	.....	
		Rock .....	.....	-62	.....	

Borings at Santa Monica Bay—Continued.

BORINGS ON 7-FATHOM LINE.

Designation of boring.	Date.	Material penetrated.	Number of feet.	Elevation of bottom.	Time of penetration.	Samples.
a	Feb. 25	Water	43	-43	m. s.	No. XL.—Elevation —49, fine gravel; yellow clay on reducer.
		Fine sand	3	-46	0 15	
		Fine gravel and boulders.	3	-49	.....	
β	Feb. 25	Yellow clay	44	-49		No. XXXVIII.—Elevation —47, fine sand. No. XXXIX.—Elevation —50, fine gravel.
		Water	44	-44	.....	
		Fine sand	4.5	-48.5	30	
		Coarse gravel, boulders.	1.5	-50	.....	
γ	Feb. 25	Water	44	-44		No. XXXVI.—Elevation —51, fine sand. No. XXXVII.—Elevation —52, fine gravel.
		Fine sand	8	-52	16	
		Fine gravel .....	.....	-52	.....	
δ	Feb. 25	Water	44	5	-44.5	No. XXXIV.—Elevation —54, fine sand, with broken shells. No. XXXV.—Elevation —55, yellow clay from outside of reducer.
		Fine sand	10	-54.5	30	
		Large boulder .....	.....	-55	.....	
		Yellow clay .....	.....	-55	.....	
e	Feb. 25	Water	45	-45		No. XXXII.—Elevation —48, fine sand. No. XXXIII.—Elevation —64, blue clay.
		Fine sand, with clay lumps.	13	-58	20	
		Small stones	1	-59	.....	
		Clay	5	-64	5 30	
Extra 250 ft. north-east from.	Feb. 22	Water	42	-42		
		Soft material	4	-46	.....	
		Gravel	3	-49	.....	
		Soft material	10	-59	.....	

Borings at San Pedro Bay.

54	Feb. 26	Water	54	-54		No. XLI.—Elevation —58, stiff, greenish-brown clay; plug in pipe. No. XLIII.—Elevation —65, same as above; plug in pipe. No. XLIII.—Elevation —74, same as above, from sand pump.
		Soft clay	2	-56	.....	
		Firm clay, becoming harder with depth.	18	-74	.....	
55	Feb. 26	Water	52	-52		No. XLIV.—Elevation —57, fine sand, with some mud. No. XLV.—Elevation —54, soft clay. No. XLVI.—Elevation —63, fine sand, with some mud. No. XLVII.—Elevation —76, same as XLVI.
		Fine sand, with mud and thin layer clay near surface.	24	-76	1 30	

DETAIL DESCRIPTION OF BORINGS.

General.—In the above table the material described as fine sand was of very uniform character throughout all the borings, including that at San Pedro. The sand was exceedingly fine and contained a small amount of mud or clay, sufficient to give the sand some cohesion. When a small quantity of sand, say a pint or more, was agitated in a bucket of water the water became sufficiently turbid to be entirely opaque, but the sand settled to the bottom, making a firm layer in less than half a minute. The color was a greenish gray. In its natural position it felt rather firm to the sounding lead, but the jet pipe when rested on it without using the water current could be worked into it easily by oscillating the pipe gently. The sand described as medium is still a fine sand, but somewhat coarser than that described as fine. Sand described as coarse would be called coarse anywhere.

The elevations given are referred to lower low water.

The time of penetrating is the time actually required from the moment the jet was started and lowering of pipe commenced until it reached the given depth, delays, if any from causes other than resistance of material, being deducted. In sand the pipe penetrated by its own weight as fast as it was lowered by means of blocks and falls. In gravel and clay it became necessary to lift the pipe and drop it repeatedly in order to penetrate the material, and when working in clay two men usually aided in forcing the pipe down.

The pipe was held at all times while being sunk by myself and one experienced laborer, so we could feel the nature of resistance at any time and guide same.

Whenever boulders or coarse gravel had been encountered the end of pipe was carefully inspected to note signs of battering, and when any such had been noted the end was carefully refilled before being used again. Nothing has been reported as rock which did not decidedly batter the end of the pipe.

Whenever any clay adhered to the grooves on the reducer at the end of the pipe it was carefully removed before the pipe was again entered.

In each boring the lowest elevation given shows the extreme depth of penetration rather than the thickness of last layer of material. In each case the full depth was penetrated before any effort was made to obtain samples, and the deepest sample was always obtained first.

SANTA MONICA—BREAKWATER LINE.

α. Boring is approximately opposite mouth of Santa Monica Canyon, which may account for the yellowish clay on top of the darker colored clay.

α+. Both samples obtained at same time, pipe being first churned to get sample from surface of clay and then driven to obtain plug of clay. The latter failed, but sample of clay was found on groove in reducer.

β. Clay penetrated in two different places. Sample of clay from second penetration, though material of similar character was found on outside of reducer the first time.

β+. Pipe withdrawn from clay with some difficulty.

γ. Sand near surface of clay contained some small particles of clay size of duck shot.

γ+. In sinking through last 5 feet pipe was stuck repeatedly, and was pulled up with considerable difficulty. The coarse sand brought up from elevation -70 in pump could hardly have followed down from above under these conditions, especially as the clay around reducer was comparatively clean.

δ. Reached clay in three different places at same elevation. Sample XIV of clay brought up at first attempt; clay penetrated at third attempt; after penetrating clay pipe went down by its own weight.

δ+. The sample from fluke of anchor apparently contained a little more mud than samples obtained by sand pump. The pump probably had some washing effect.

ε. In Sample IX, from elevation -77, there was a very small lump of clay.

ε+. A boulder battered pipe; by moving pipe slightly to one side it passed by the boulder and through a bed of fine gravel; below this gravel pipe went by its own weight very quickly.

ζ. Lost pump in this boring attempting to get sample at elevation -62. Material above clay all penetrated very quickly.

ζ+. The thin layer of gravel noted at elevation -49 caused very little delay in sinking; it may be a pocket of shells.

η. A 4-inch casing was put down at this point by means of jet, the jet pipe projecting 1 foot below casing. When first started, water and sand came out freely over top of casing 15 feet above sea level, and continued to do so while pipe was being sunk 10 feet; sample was caught from this overflow. After penetrating 10 feet flow suddenly stopped but pipe continued to go down readily. Jet was stopped temporarily several times to allow material to settle around casing and thus compel flow over top as before, but without success till near limit of boring. Another momentary flow took place, the color of material being same as that above, though flow did not last long enough to obtain sample. Casing and jet both struck on rock and were both battered when pulled up; inside of casing evidently cleaned out perfectly; having lost sand pump on previous day samples could not be obtained except as noted.

SANTA MONICA, 7-FATHOM LINE.

α. Pipe penetrated with great difficulty at lower elevation.

β. Pipe badly battered at end.

γ. Gravel choked down jet so as to stop pump.

δ. Boulder of considerable size as second attempt to pass it, in new hole 2 feet from first, failed. Third attempt to pass boulder, in hole 2 feet from first in other direction, was successful; pipe was pulled with difficulty.

ε. Layer of small stones very marked and felt, from glancing of pipe, as if the size of eggs.

Extra.—Soft material is undoubtedly the same fine sand found in other borings. This boring was made when lighter was anchored in wrong position, owing to dragging of buoy, and was waiting for assistance of tug.

SAN PEDRO BORINGS.

No. 54. Surface of ground soft, but increased very rapidly to hard material; rate of progress in penetrating 20 feet very uniform, 11 feet being penetrated in seven minutes; 20 feet in fifteen minutes. Sample XLIII was obtained after churning and driving from inside of sand pump, but not as a plug. In sinking, the pump was stopped by clay in nozzle at every downward stroke of the pipe.

This boring is on the line of the proposed breakwater, 500 feet easterly of Hunt's most easterly boring.

No. 55. In sinking, momentarily encountered a hard layer at elevation -63, but efforts to get samples from this layer failed. Pipe was put down four different times to various depths, but failed to get anything but sand in pump. The soft clay found on reducer each time must be very close to surface.

This boring is on the line of proposed breakwater, 1,000 feet easterly of Mr. Hunt's last boring.

In all these borings the samples were generally taken from the pump by myself; in a few instances, when this was not the case, they were taken from pump in my presence and immediately handed to me. The samples were at once put into their final receptacles, consisting of 2-ounce glass jars. At the end of each boring the samples from that boring were numbered on the tin cover by means of a file and a proper record entered in the note book. At no time were there samples from two borings unmarked. These samples were sent to you by express on the first train on the morning following the day when they were obtained. As no duplicate set could be obtained, the samples thus sent to you are the ones referred to in this report.

Daily reports by wire and by letter giving a record of the day's work were sent to you each evening. The entire matter in this correspondence is, however, given in this report.

After completion of the borings the tools and materials purchased by authority of the Board for this work were turned over to the Government storekeeper at San Pedro and the party disbanded on the 27th of February. Mr. Hunt and myself went to Los Angeles that evening. The accounts being all brought in by next day, I left Los Angeles the evening of the 28th.

Yours, respectfully,

E. GERBER.

J. G. WALKER.

Rear-Admiral, U. S. N., Chairman.

Admiral JOHN G. WALKER,

Chairman Deep-Water Harbor Board, Washington, D. C.

APPENDIX F.

BOARD FOR LOCATING A DEEP-WATER HARBOR IN SOUTHERN CALIFORNIA.

STENOGRAPHIC REPORT OF TESTIMONY AT PUBLIC HEARINGS IN LOS ANGELES, CAL.

FIRST DAY.

DECEMBER 21, 1896.

The chairman called the meeting to order at 10 a. m., all members of the Board being present.

The CHAIRMAN. The advocates of Santa Monica and San Pedro have agreed as to the order in which they are to present their cases. Santa Monica will lead off, followed by San Pedro, and then each side has a second inning in the way of rebuttal. Each side is expected to present its full case in its first argument; nothing will be allowed in rebuttal that is new matter. If anything is forgotten in the first instance, that is the fault of the advocates of that side. No interruptions will be allowed. If the opposite side wishes to ask any questions, they will be kind enough to put the questions in writing, and send them up to the Board, to be asked by members of the Board. Santa Monica now has the floor.

Mr. WILLIAM HOOD, chief engineer of the Southern Pacific Company. Mr. Chairman and gentlemen of the Board, the first presentation of the case of Santa Monica Harbor will be by Mr. E. L. Corthell.

Mr. CORTHELL. Mr. Chairman and gentlemen of the Deep-Water Harbor Board of Southern California, I desire to present in the way of a brief introduction a condensed history of the inception of the present system of Government harbor improvements, and of my own connection with the question submitted to you by Congress.

A decade has passed since a number of civilian engineers, representing several engineering societies in various parts of the United States, endeavored to establish through Congressional action a rational policy of national public works, both as to legislation and the conduct of these works; and in respect to the latter feature the supervising of the works was to be open to army and civilian engineers according to experience, skill, and general fitness. A bill embodying the necessary legislation was introduced in the Senate and House, and was known as the Cullom-Breckinridge bill, as Senator Cullom and Mr. C. R. Breckinridge, respectively, introduced and managed the bill in the Senate and the House.

The executive committee of engineers, by correspondence, petitions, hearings before committees and the President, Mr. Cleveland, pressed upon Congress and the Executive the great importance of the reforms contemplated.

The failure to accomplish the purpose in view was not our fault. However, two important changes resulted from the discussion. The whole country has been divided into engineering divisions almost exactly as was proposed by us, and there has been established as a permanent method of legislation and construction what is called the "Continuing-contract system," by means of which the money for carrying to completion most of the important river and harbor works is made available at the outset, avoiding the excessive waste and absence of results by the old and faulty method. As an instance of how faulty it was, look at San Diego, where this system has not yet been applied: Fifty to seventy-five thousand dollars only are appropriated in the river and harbor bill for the jetty construction there, and the annual waste and loss through the destruction of incomplete works by the waves and terefo, and other causes, and increase of final cost by the deepening of the bar in advance of the work, are greater than the appropriations.

Hon. N. C. Blanchard, a leading member and then chairman of the House Committee on Rivers and Harbors, was a strong advocate of the Cullom-Breckinridge bill, and appreciating the great importance of better legislative methods succeeded subsequently in introducing the continuing-contract system, and gave the history of the change in methods in an interesting article in the *North American Review*.

The Board will appreciate from this brief statement my readiness to seize the opportunity presented in the winter of 1893 of assisting Congress to decide an important harbor question when there was a pronounced difference of opinion between the committees of Congress and two Boards of Army Engineers. This question was, where shall a deep-water harbor be built, at San Pedro or Santa Monica?

My attention had been called to the subject by Mr. Huntington, with whom I was having some professional business in reference to the proposed bridge over the Mississippi at New Orleans. I told him I would examine the conditions and report my conclusions to the committees if I could obtain a request by these committees or by some leading members of them to make the examination and report. I saw Senator Frye and Mr. Blanchard, both of whom urged me to go to California and then to report my conclusions. It was understood definitely with them and with Mr. Huntington that I was to be entirely untrammelled and was to report according to my convictions, which I did in June, 1894, in some remarks before the Senate committee, found in bound volume 4, in the hands of the Board.

After that I was ill in Europe, as some members of the Board know, for many months, but had the subject in mind even then and there.

I was this last winter retained by Mr. Huntington to represent Santa Monica interests with the War Department and before the committees of Congress. A petition was presented by his company accompanied by location, plan, and estimate of cost prepared by Mr. Hood, chief engineer of the company, which plan and estimate was concurred in by the War Department.

It is a question of personal privilege that I give the preceding résumé of my connection with this subject, and the reasons why I have stated these facts the Board, I doubt not, fully understands and appreciates.

The Board provided for by Congress having been appointed I was again requested by Mr. Huntington to represent the interests of Port Los Angeles, and this brings the history down to date, except that I shall later on give briefly some facts as to the history of the legislation which do not appear in the printed proceedings of the committee hearings or Senate discussions.

I desire to state briefly at the outset that from printed and other data, and from charts, experience, and testimony from experts, it will appear or be fully proven:

First. That the "deep-water harbor for commerce and of refuge" mentioned in the act constituting the Board refers only to a harbor for deep-draft ocean merchant vessels, and has no reference to the local harbor at Wilmington, or to a harbor for naval or military purposes, or defensibility, although both of the alternate harbors named in the act may be equally adapted to these latter purposes.

Second. That the harbor to be provided is primarily for the ocean commerce of the entire country, and not especially for the section of the country in which the harbor is situated.

Third. That the question of the necessity for a harbor has already been settled in the affirmative by Congress, and there remain only the questions of location and structure, and further, that the action of this Board upon these questions is to be final.

Fourth. That the nautical and maritime conditions generally as to winds, waves, and currents and their drift action are more favorable at Port Los Angeles than at San Pedro, and that a breakwater at San Pedro would cost more to build and maintain than one at Port Los Angeles.

Fifth. That the holding ground for anchorage at Port Los Angeles is at least equal to that at San Pedro, and that wharves can be much more conveniently built and maintained there.

Sixth. That the land approaches by rail at Port Los Angeles are much superior and much more free from obstructions to entrance.

Seventh. That during three years past the great pier at Port Los Angeles has been in continual and generally safe use by large ships.

Eighth. That the successful operation of this pier for so long a time in an unprotected sea way establishes the superiority of this location, and that it will be generally acknowledged without argument that it would have been impossible to operate one at San Pedro without a breakwater.

Ninth. That the location at Port Los Angeles has advantages over San Pedro in respect to the regular coastwise passenger and freight traffic where time is of any importance.

Tenth. That even if a breakwater were built at San Pedro, the advantages and present commercial facilities of Port Los Angeles would still command the ocean business.

Eleventh. That the suitability of a detached breakwater under the condition existing at Port Los Angeles is proven by experience in this country and other countries where a large number of such works have been built and maintained for commercial purposes.

The act requires a brief explanation to show how it came to be framed as it is, and to assist in interpreting it.

A hearing before the House committee had been given to the advocates of Wilmington Harbor. Some little time afterwards a hearing was granted by the same committee to the advocates of Port Los Angeles. Items for both harbors were placed in the bill, the advocates of Wilmington and San Pedro opposing the appropriation for Port Los Angeles. The House committee thereupon, with considerable feeling, threw both the Wilmington and Port Los Angeles items out of the bill. The bill then went to the Senate committee, which replaced both items and thus reported the bill to the Senate, Port Los Angeles, as against San Pedro, being favored as a deep-water harbor by 11 to 4 in the committee. The remaining history of this measure appears in the Senate discussion.

The Southern Pacific Company had agreed from the first, two years before, in the preceding Congress—I am referring now for convenience and to save time to the exhibits of various kinds which are in the hands of the Board (see bound volume 4, pp. 14 and 15)—that the royalty on stone, if taken from its quarries, should not be greater than 12½ cents per cubic yard, and that the charge for transporting it should not be greater than one-half a cent per ton per mile, and that any other railroad company should have, if they desired, the use of its approaches and tracks and the right to cross its tracks and right of way, and it agreed to build under the bluff, if it should be necessary for the business of the railroads, ten additional tracks. It also agreed to give any other company the right to use its great pier built at Port Los Angeles. The object of making these propositions was to remove objections that had been urged against Port Los Angeles as a deep-water harbor and to make it freely and fairly used by any and all railroads. These are the reasons why certain requirements upon the Southern Pacific Company were incorporated in the act.

Referring to the words in the act, "deep-water harbor for commerce and of refuge," "deep water" was used to convey the idea that the harbor question was not in any way connected with the local harbor at Wilmington. Even if the deep-water harbor should be located at San Pedro, it was to be an outside harbor for ocean-going vessels. The views of the chairman of the Senate Committee on Commerce, Senator Frye, no doubt expressed those of Congress on this point, and the following paragraphs are quoted from his speech, as appears on page 2 of the Senate discussion:

"I think the Senator from Missouri describes the conditions at Los Angeles about right, but what has Los Angeles to do with this, anyway? Why, the Senator from Missouri and I have been in this fight about eight or ten years, I believe. We know all about it. We have got tired of it, too. I am very sorry to find him willing to have it run any further. I wish to get rid of it forever. I never want to hear of it again.

"Give San Pedro an inner harbor of 18 feet depth of water, and it will accommodate all the commerce of Los Angeles for the next fifty years. It is ample for it. If you put a breakwater outside of the interior harbor you are throwing away \$392,000.

The idea that the Los Angeles people are to instruct Congress where they shall put a harbor! For the commerce of Los Angeles! Nobody has ever talked about that. It is for the commerce of the world; and not only is it for the commerce of the world, but it is for a harbor of refuge, just as important as a harbor for commerce. The Atlantic Coast has harbors of refuge all along. We are building one now at Sandy Bay, on the New England coast, at a cost of \$5,000,000, and we have them every 40 or 50 miles—harbors in which tempest-tossed ships can run for refuge. They are just as important for protection to life and property as are protected harbors for commerce.

"The harbor that we are talking about here is not a little harbor for a town or a city. It is a harbor for the commerce of the world, a harbor for the ships of the world, and Los Angeles has no more interest in it and no more to say about it than the people in the city of Portland, Me."

The words "for commerce and of refuge" mean that the harbor to be provided is not for war purposes, either naval or military, except as a refuge when naval vessels wish to use it just as commercial vessels do—for that purpose or for obtaining supplies. It was not intended to be a place for Government dry docks; that is, that feature is not a part of the question at issue, though both localities may be suitable for that purpose. Again, the question of defensibility in time of war is not involved, although both places may be equally defensible. The Board of United States Army Engineers in 1892 favored San Pedro, and General Miles in 1894 Santa Monica, stating in a letter to Senator Fry: "In the immediate vicinity of Santa Monica there are very high and commanding bluffs upon which land batteries of mortars and rifle guns could be placed, which would render the harbor easily defended." (See p. 11 of Senator Frye's speech.) But in order that it may be further seen that the question of fortifications is not involved, the following allusion to this feature in the Senate discussion is given:

"Mr. VEST. That struck me, because I have always believed that that is the defect in the system of putting all the rivers and harbors exclusively under the Engineer Corps. I asked General Craighill especially that question, and he said: 'We are not riparian engineers; it is for the Coast and Geodetic Survey to examine the floor of the ocean and make soundings; but we are fortification engineers.'" And if you will take the report upon San Pedro you will find one-third of it, speaking with all due limitation, is as to the point of defending San Pedro in case of war, proving that they were fortification engineers, and looked upon the subject from that view of the case. (See p. 5542 of the Senate discussion.) And the following is also extracted from Senator Vest's speech:

"These engineers went to San Pedro and Santa Monica. Their first idea was how these places were to be defended in case of a naval war, and when they looked at any improvement upon the seacoast that is naturally their first idea, because they are West Pointers, trained in the art of destroying men and of defending localities." (See p. 5593 of Senate discussion.)

The following paragraph on the same subject is from Senator Frye's speech:

"A Board of Army Engineers made its report, and I declare that never in a single instance did the first Board of Army Engineers or the second Board of Army Engineers, either one of them, condemn Santa Monica as a harbor, and no condemnation of it can be found in their report. They simply expressed a preference for San Pedro and gave their reasons, and the most prominent reason was that it was better adapted for fortification than was Santa Monica. That was the principal reason, and, as the Senator from Missouri has said, occupied more space in their report than did anything else." (See p. 3.)

These extracts are simply illustrative of much that was said in the discussion on this subject.

The alternative outer harbors to be formed by the breakwater for which the appropriation is made is the limit of the question at issue. This is indicated clearly by the provisions of the act relative to Wilmington Harbor; the item for this harbor reads as follows:

"Improving Wilmington Harbor, California, in accordance with the project submitted February seventh, eighteen hundred and ninety-five, fifty thousand dollars: *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three hundred and forty-two thousand dollars, exclusive of the amount herein appropriated, fifty thousand dollars; but no such contracts shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and of refuge, as between Port Los Angeles, in Santa Monica Bay, and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor." (See p. 14 of the act, being X of bound volume.)

That is, Congress was unwilling to do any work at Wilmington on the inner harbor

if the outer harbor should be built at San Pedro; and facilities there for local commerce requiring deeper water than the present works have provided, 13½ feet at low water, must be established in the outer harbor; in other words, they must abandon the inner harbor and move out. From these various proofs submitted I again assert, with your consent and forbearance, that in my opinion the inner harbor at Wilmington has nothing whatever to do with the questions submitted to the Board, and I may say, further, that if the Board should locate the deep-water harbor at San Pedro, Congress expressed itself as unwilling to consider the local coastwise commerce doing business at Wilmington of enough importance to justify making the channel provided for in the Wilmington Harbor Item, Congress considering that, improved to the present extent and supplemented by the use of the outer harbor, or, conversely, if the Board should locate the deep-water harbor at Port Los Angeles, the present inner harbor at Wilmington, improved to a depth of 18 feet, according to the present project, "will answer the purpose for the ordinary trade of the Pacific Coast."

I am desired by the chairman of the Senate Committee on Commerce to state these interpretations of the act to the Board, otherwise I might well hesitate to do it even though I knew, as I do, from intimate knowledge of the discussions in the committee and the Senate, what were the views of the majority of the committee and of other Senators and Representatives.

I will, therefore, go still further in clearing up this point, and say that the views of the chairman of the Senate committee, which I consider are the views of his colleagues as well and express the purpose of Congress in making this appropriation, are the following: The committee was considering a great commercial harbor, one that would accommodate the great ocean-going steamers doing the carrying trade of the Orient. It was believed, by the chairman at least, that in the future our commerce on the Pacific would be at least equal to that on the Atlantic, particularly when the Nicaragua Canal should be constructed by our Government, bringing us nearer to the 500,000,000 of people of the East than Great Britain is, also that Wilmington would do very well for the local commerce and for the small coasting vessels loaded with lumber and other products of the Pacific Coast, but would prove entirely inadequate for a deep-sea commercial harbor. And referring once more to the question of fortifications, the army engineers placed great stress upon the defensive qualities of a harbor, but the chairman of the committee believes that in constructing a harbor, or in the improvement of one already partially constructed, Congress has never given any consideration to the question of its defense. The state of the case being as I have outlined it, and the evident purpose of Congress being to expend for harbor improvements, first, for a deep-water harbor for the whole country \$2,900,000 if located at Port Los Angeles, and for a local harbor at Wilmington for the benefit of the section of the country tributary to Los Angeles \$392,000, a total of \$3,292,000, the question appears to resolve itself, so far as the interests of this location and the whole country are concerned, and I fail to see what possible motive the real commercial interests at Wilmington can have in opposing the location of the deep-water harbor at Santa Monica, for if it is located at San Pedro the inner harbor at Wilmington, with its shallow depth and crooked entrance, is deprived of the \$392,000 which Congress would expend upon it if the deep-water harbor shall be located at Port Los Angeles. In other words, the interests at Wilmington, local, coastwise, or railroad, must, for deeper and larger channels, and generally larger facilities move out into the outer harbor, which, in the course of this discussion will be shown to be unsuitable for them and inaccessible for the railroad located on the east side of the river, and approachable only at great inconvenience by the railroad company now on the west side, and which railroad company has not now and never will have any desire to utilize the space back of a breakwater as proposed at San Pedro. It is safe to predict, judging from the temper of Congress, as shown this last session both in the Senate and the House (I use the word "temper" advisedly), that the \$2,900,000 provided for an outer harbor at San Pedro, if the Board should locate it there, is all that this part of California will obtain from the Government for a quarter of a century to come; but that if the deep-water harbor for the commerce of the whole country should be located at Santa Monica, then the local Wilmington commerce will have not only the nearly \$400,000 now provided for that harbor, but may reasonably expect further appropriations in the future if it can be shown at any time that the local commerce there requires further facilities.

The subject of a deep-water harbor, thus simplified and divested of local commercial features and military questions, naturally divides itself into maritime features and land features, the former into sea approaches and commercial facilities and the latter into land approaches and railroad facilities.

I may be permitted to express further the satisfaction that all interested must feel in being able to present now, after years of controversy, the important conditions of this question to a Board appointed by Congress really as referees or a court of last resort, the action of which is absolutely final, not to be reviewed, criticised, annulled, approved, or disapproved by any legislative or executive department of

the Federal Government. This feature of the case gives to the Board unusual and extraordinary powers, and it is exceedingly important for all commercial interests affected by the decision that Congress decided to leave the question at last to an absolutely impartial Board.

I will now enter upon the technical discussion of the subject. I shall attempt to follow a logical order, discussing principally the maritime features, leaving most of the land features and many details of even the maritime conditions to my associate, Mr. William Hood, chief engineer of the Southern Pacific Company, whose familiarity with and knowledge of the details is far in advance of my own. I shall, for convenience and to save time and description, make references to a bound volume containing ten printed documents, a set of bound exhibits, a large number of unbound exhibits in the shape of charts, plans, etc., and to a bound volume of the Senate discussion upon this subject.

First. Santa Monica is a deep indentation of the coast line, and is, at Port Los Angeles, where the Southern Pacific has built its great pier, 12 miles inland from a line drawn between the headlands of Point Vincente and Point Dume; San Pedro is at Point Firmin, a headland itself, and the breakwater proposed there must necessarily be in the open ocean beyond this point. These general features are plainly shown by the large map and the two Coast Survey maps which have been joined together and which are exhibited to the Board. The larger map, about 13 feet in length and 5 feet in width, is an enlargement by pantograph from the Coast Survey map, and is therefore, as far as general outlines are concerned, sufficiently correct for the purpose of a general exhibition of the main features of the coast. The topography upon it, where roughly shaded, is also sufficiently correct to give an idea of the altitudes back of the coast line.

Second. The sea slope at Santa Monica, from the shore to 300 fathoms, a distance of about 12 miles, is quite even and uniform, and nowhere abrupt. The sea slope at San Pedro is very steep from a point 2 miles from the proposed breakwater. The blue-print profile exhibited of the sea bottom at both places is drawn from the assumed position of the breakwater at each harbor and in a direction seaward of south 35° west, from which the heavy ocean swells approach both works.

Mr. MORISON. Will you please designate by your pointer on the large map just where those profiles are? What I mean is, will you lay your pointer flat against the map in the position in which your profile is made?

Mr. CORTHELL. It is about 7° from the arrow.

Mr. MORISON. That is the exact position of your profile?

Mr. CORTHELL. As exact as I can lay it on there.

Mr. MORISON. Now, will you be kind enough to do the same for San Pedro?

Mr. CORTHELL. The same variation, about 7° from that arrow, which is south 42° 24' west.

Mr. MORISON. It is not merely the direction; it is the point?

Mr. CORTHELL. As near as I can draw it, about 7°.

Mr. MORGAN. Is that magnetic?

Mr. CORTHELL. Yes, sir. Generally, in all these discussions the magnetic bearing is used. It is unfortunate, for the reason that the variation is great on this coast, being over 14° east. Still, in all our discussions, we will use it. The difference between the true and magnetic bearing is shown by those arrows. Now, referring again to the profile, the horizontal broken lines represent depths by 50 fathoms, the vertical broken lines distances from the breakwaters by miles. It will be seen that from a point 3 miles to 4 miles distant from the breakwater at San Pedro, the sea bottom drops from about 50 fathoms to over 300 fathoms, while the Santa Monica slope, at a distance of 10 miles from the breakwater, is still but a little over 200 fathoms below the surface of the water.

From the Santa Monica profile and from the even lateral slope in the sea bottom as well, it will be apparent that the waves, after passing inland from Point Dume, materially feel the effects of a shoaling sea bottom and are retarded and lessened very considerably before reaching the vicinity of the proposed breakwater.

Santa Catalina Island has been stated to protect in a measure the proposed harbor at San Pedro. The following magnetic directions will show that this is incorrect. The ordinary ocean swell as given in No. 11, bound volume, page 7, being the report of the Board of 1892, is south 45° west; the least heavy ocean swell is about south 35° west, the heaviest ocean swell about south 30° west. The extreme westerly end of Santa Catalina Island is south 34° west from San Pedro, which shows that the ordinary and heavy ocean swell is not interrupted by any portion of Santa Catalina Island. The eastern end of Santa Catalina Island is south 14° east from the San Pedro breakwater and the winter storms come from a direction south 54° east, showing that this island does not protect the breakwater from these storms. Point Loma, at San Diego, is south 55° east from San Pedro, so that there is not for many hundred miles any land to obstruct the travel of the waves, which, as is well known, are, other things being equal, the greatest where there is the greatest "fetch."

During the discussion in the Senate committee last session, a discussion was also going on in the House Committee on Interstate and Foreign Commerce upon the report of the Nicaragua Canal Board and an answer of Colonel Ludlow to a question put to him by a member of the committee particularly applicable to the subject of wave modification by sea slopes. The subject under consideration was the proposed harbor at Brito, at the Pacific terminus of the canal, and the conditions as described by Colonel Ludlow, both topographic and hydrographic, are quite similar to those at San Pedro. The following is from his remarks:

"The water deepens there very rapidly; you are in 10 fathoms very soon, and in a mile and a half you have gained 26 or 27 fathoms and in another mile you have gained 10 fathoms; on the Atlantic Coast our depth runs about a fathom to the mile, and in this case within 2½ miles we have 36 fathoms or some such matter on the Pacific. That is the reason that these fearful swells come in, as there is no shallow water to diminish the roll." (The italics are mine.) I was interested to make a comparison between the sea slopes of Brito and San Pedro from the charts. This comparison is as follows:

Comparative sea slopes.

Distance from breakwater.	Brito.	San Pedro.
	Fathoms.	Fathoms.
One-fourth mile.....	11	11
One and one-half miles.....	20	30
Three miles.....	30	55
Four miles.....	33	300

From this it will be seen that the steepness of the slope at San Pedro is much greater than at Brito, and consequently, for the reasons given by Colonel Ludlow, the swells coming in to the breakwater should be much more "fearful."

As an additional confirmative opinion on this subject, I give the following extract from a communication by Commander H. C. Taylor, United States Navy, who has had, from his own statement, considerable experience in Santa Monica Bay while conducting the surveys carried on there and who has lain at anchor at all seasons of the year at and near Santa Monica on the Government vessel which he commanded.

"The bay of Santa Monica is, in its combination of natural features, unique on the Pacific Coast. Here the depth of the water increases from the beach outward with an easy and gradual slope for several miles. Here a breakwater can be established to inclose and shelter a capacious harbor without being in water so deep as to make its construction impracticable or even difficult.

"The marked feature of the Pacific coast is the steep slope of the bottom as we move from shore to seaward. This rule has few exceptions, and it results that along the entire coast a breakwater to inclose a sufficient sheltered area would have to be placed in such deep water as to be impossible of construction.

"Among the few exceptions is the bay of Santa Monica. It is a remarkable coincidence that the coast line in a deep curve here approaches nearer than at any other point to Los Angeles and to the fertile region of which it is the depot.

"The bay of Santa Monica has, along most of its shore line, this quality of gradual deepening of the water, the bay of itself being occupied by a submarine plateau unique upon the Pacific Coast.

"The swell which rolls in at this anchorage is much modified, even in the worst weather, by the effect of the large islands to seaward and by the deep recessed position of this portion of the bay shore.

"I have never seen any weather in which a vessel could not ride at her anchors there in safety, and but few occasions when unloading at a wharf was impracticable." (See pp. 109, 110, bound volume II.)

The above was written some years ago, but the favorable opinion of Captain Taylor has not been changed, as will appear by the following extract from the speech of Senator Frye in the Senate discussion of this subject:

"Then he (Taylor) goes on to argue the necessity of a great harbor and the absolute necessity and practicability of locating it at Santa Monica. Captain Taylor is now the president of the Naval War College at Newport. At the request of the committee I wrote to Captain Taylor, informing him that there was to be a hearing before the committee on such a day, and asking him if he would not be present and give his testimony. He received the letter too late for the hearing. He wrote me that he would come at any time the committee desired, but that he must be authorized to do so by the Secretary of the Navy. A telegram was sent to him the next day, in order to save him from coming, if possible, to know whether or not he had changed

his mind any about Santa Monica since he made the report, and he said in a telegram: 'Nautical advantages excellent. Natural location great port. My opinion strong.' (See speech of Senator Frye, p. 11.)

An examination of the large map exhibited will show that the heavy ocean swell strikes the Santa Monica breakwater at a much better angle than at San Pedro. At the latter place, if the breakwater should be designed according to the plan of the Board of 1892, there will be only one point where the direction of the heavy swell will be normal to the dike; elsewhere it will strike it at a sharper angle. It is well known by those familiar with the construction and maintenance of these works that the greatest destruction to jetties and breakwaters is caused by what are termed "racers," which rush with great rapidity along the line of the work, often ripping up and scattering very heavy blocks of stone or concrete.

I have myself seen the mark made by a 20-ton concrete block moving diagonally across the top of the breakwater at Ymuiden, at the entrance harbor of the Amsterdam Canal. This block, and there have been others as well, was lifted by the racing waves probably 10 feet, moved along and across the breakwater another 15 feet and thrown into the harbor.

I have seen the sea side of the Maas north jetty shingled diagonally, not normally, to the axis of the jetty to meet the destructive action of the "racers;" and at the South Pass jetties, on the storm wave side, it was necessary to build cribs of logs and stone to prevent these "racers" from destroying the work.

I could give many other illustrations on this subject. But you will see by examination of the map that with the exception of this right arm of the Port Los Angeles breakwater [indicating] the direction of the heavy swell, as I point it out to you—you must go by my pointer—will strike nearly square all the way the whole length of the wall in deep water. But you can very readily see that with any breakwater put at that point—Point Firmin—that it will strike that of course at some point at right angles; but from that point on to the end of the breakwater the racing gets worse and worse. I shall show farther on, as I have already stated, that it would cost more to build and maintain a breakwater at Point Firmin than it would at Santa Monica.

Third. In reference to the topographical features, the country back of Santa Monica Canyon is very high. This has the effect of deadening the winds for some distance seaward as they approach the shore; this high land also protects the harbor from violent northerly and northwesterly winds; the headland and highlands on the southeast of Santa Monica Bay furnish also some protection against the southeast storm winds. At San Pedro these conditions do not exist, except that San Pedro Hill protects against the northwest wind, but the country back of it is not of sufficient altitude or of sufficient mass to cause the deadening of the winds from the ocean and the winter winds would blow directly into the entrance of Wilmington Channel. These topographical features are clearly shown by the large map exhibited. The mountain heights back of Santa Monica are nearly 2,000 feet above the level of the sea to the northwest. That I am not alone in the opinion as to the effect of the highlands lying back of harbors in deadening the winds offshore, I will quote from Commander Taylor from the same communication as before:

"But certain portions of the shore line of the bay have other advantages in addition. The town of Santa Monica is situated at a point on the shore near a neighboring range of mountains, against or toward which blow the only winds of violence. The force of the wind blowing against a great barrier is deadened for some distance to windward of such barrier, and this probably accounts for the well-known fact that the winds of Santa Monica do not blow with violence." (See p. 110, bound volume II.)

Mr. Hawgood criticises the plan of the Board of 1892 in reference to wind exposure at San Pedro as follows:

"The proposed breakwater is deficient in that it would afford no protection whatever to the mouth of the inner harbor against the winter storms from the southeast. The entrance would continue to be exposed to their full force as at present." (See p. 8, bound volume III.)

Senator Frye, as you are aware, has had for a layman large experience in the study of maritime subjects; and while he may not be a navigator, is sufficiently familiar with navigation and its conditions to enable him to give a reliable opinion on many subjects of this nature. The following paragraph is from his speech on this subject:

"I wish to call your attention to one point more in this connection. You see that arrow is southwest [indicating]; as a matter of course, southeast would be this way [indicating]. Will any Senator tell how that breakwater protects the proposed San Pedro Harbor from the southeast gales? Not the slightest under the sun. The southeast gale comes right square into the mouth of it. As a matter of course, if the breakwater be extended away around it could not keep the wind out. It has full sweep and full away. It is admitted by everybody in this controversy that it is the southeast wind that the mariners are afraid of on the Pacific Coast. Yet the harbor

of San Pedro, fix it up the best way you can, is right out with open arms, apparently anxious to receive into its bosom the terrific southeast gales, while the other one is absolutely protected from them." (See p. 2, Senate discussion.)

I have reliable information from an eyewitness about the loss of vessels at San Pedro from these southeast winds. The masters of these vessels used their utmost endeavors to get out of the harbor and go to sea, as their anchors were dragging and they were going upon the rocky beach, but the choppy sea prevented their escape.

There are submitted statements made by shipmasters who are familiar with Santa Monica Bay and with Port Los Angeles particularly, and in these will be found many corroborative evidences of favorable wind and wave conditions at Port Los Angeles. These are marked Exhibit N.

In the letter of George Hansell, master of the British bark *Fernbank*, April 11, 1896, is a very forcibly and nautically expressed statement in regard to wind and wave conditions at Port Los Angeles: "Of course it is well understood that a lee shore is a bad anchorage, but the contrary is accounted for (at Port Los Angeles) by the fact that the mountains of the Coast Range prevent the winds from blowing home and the gradually sloping sea bottom of the bay retards the swell so that it does not attain the size and force that it would under ordinary circumstances."

C. H. Anderson, master American steamer *Progreso*, January 3, 1896, writes as follows:

"On my way down to Port Los Angeles I encountered very heavy weather all along the coast, particularly off Point Concepcion. After rounding point Dume, as I approached Port Los Angeles, I was surprised to observe how the waves gradually moderated and after arriving at the anchorage to find that the sea was comparatively smooth. Since I have been lying at Port Los Angeles a heavy southeast gale has been prevailing all along the coast, the bar at San Francisco breaking, yet no bad effect has been felt here, either from the sea or winds."

The conditions described are further confirmed by George Dottmers, master steamer *Alcatraz*, December 28, 1895:

"In conclusion, I would say that during the many voyages I have made to this port, although experiencing some very heavy weather and seas in Santa Barbara Channel, on approaching Port Los Angeles I have found the swells diminish and cease altogether when getting within a couple of miles of the harbor. I have laid alongside the wharf during all kinds of weather and have not seen the time when I could not load or discharge my cargo with safety and dispatch."

This is the testimony of a vessel master who has been engaged in the seafaring business on the Pacific Coast since 1873, and claims to be thoroughly acquainted with each and every port on the coast from Puget Sound to Lower California. It may be pertinent to state still further that he writes that at one time he was in favor of San Pedro as a deep-water harbor and even signed a petition in favor of that port, but this was before he had been at Port Los Angeles and was not aware of the possibilities it possessed. The opinion he has given in regard to the nautical conditions there was after having made some twenty eight trips to the wharf, which have entirely changed his opinion as to the merits of the two places.

As no doubt the reports of previous Boards will be carefully examined by the present Board, I wish in this connection to call attention to a rather remarkable statement made on page 19 of Ex. Doc. No. 41, being II of bound volume, in which appears the following:

"The San Pedro Hill, 1,493 feet high, which forms the west side of the bay, furnishes a more protected shelter from wind and sea than could be afforded by any artificial structure in Santa Monica Bay."

When the height of the country north and northwest of Santa Monica Bay is recollected, the question may be asked what this expression means; for certainly if the isolated San Pedro Hill protects that bay, why should not a range of mountains nearly 2,000 feet high equally protect Santa Monica Bay?

Fourth. The drift of sand along the shore by the ocean currents would shoal seriously a protected harbor formed by a dike connected with the shore at Point Firmin, and should an opening to avoid this disaster be left in the dike it would let in the ocean swell to the damage of shipping; at Port Los Angeles the dike will be parallel to these shore currents and would cause no deposit, nor would wharves built on piles, as has been proven by the experience at the great wharf built three years ago. (See Profile Exhibit No. 3.) As this opinion, already expressed in the discussion of this subject before the Senate, has been combated, it is necessary to go into considerable detail in order to state the conditions and to draw conclusions from the works constructed elsewhere. I refer the Board to the bound Exhibit I, being a memorandum in relation to Pacific Coast currents taken largely from the "West Coast South America, No. 89," published in 1889, page 114. The existence of a northwest or northerly current is noted at various points from near the southern limits of South America to British America. "This current aided by the wind carries enormous

masses of sand along the coast of Araucania and is found as far north as Valparaiso. This sand is deposited at all capes projecting there westward and in all bays and harbors projecting there eastward." This current is called the Humboldt current of Peru, its velocity varies greatly, but is generally greater near the coast. The current has also been found in the Gulf of Panama setting to the northward with a velocity of from 24 to 26 miles per day, extending offshore about 60 miles.

Professor Davidson, recently of the United States Coast and Geodetic Survey, is the discoverer of the Davidson inshore eddy current, existing along the western coast of the United States. In addition to these littoral currents, which, of course, are at times changed and even reversed by opposing winds, there is usually along the coast of California a strong flood-tide current occurring twice each day. It is at times sufficiently strong to carry sand along with it; its direction is generally northerly, striking the coast often at an angle. The depositing action of these northern currents is seen at many points; at San Diego an immediate effect of building a dike into this current is described in the report of the engineer, Mr. F. C. Turner, dated June 30, 1895.

"The beach has built out farther (that is, since the report of the previous year) at the root of the jetty, so that the low-water mark is nearly to the end of the approach curve. The above accretion extends eastward about 200 feet.

"As was expected, a channel formed during the winter across (around) the end of the jetty. The flood tide is predominant so far, swinging around the end from the east and from along the shore at San Pedro.

"The strongest current (flood-tide current) I have yet noted is about 2 feet per second across the jetty." (See pp. 3276 and 3277, part 5 of the Report of the Chief of Engineers for 1895.)

The facts in regard to the northerly current, above referred to, are stated in a professional paper read before the American Society of Civil Engineers, March 15, 1893, by Maj. Thomas W. Symons, United States engineer, a member of the society:

"*Currents.*—The main drift of the waters off the coast is from the north, westward. This is the flow of the great Japan stream after striking the northwest coast. The great ocean current produces a reflex eddy current to the northward. This northerly inshore eddy current is established by much cumulative evidence. It is stated by Professor Davidson that nine out of ten of the buoys that go adrift off the Columbia River go ashore to the north at distances varying from 20 to 100 miles. A remarkable instance of this drifting to the north is that of a large nun buoy, which went adrift from the Columbia River bar in January, 1889, and traveled in one hundred and sixty-seven days 1,540 miles up into the waters of Alaska." (See p. 156, Exhibit A.)

The movement of sand is graphically described. On page 158 he states:

"The Coast Range of mountains, the summits of which are at an average distance of about 20 miles from the shore, are composed mostly of sandstone, of which a great portion is soft and easily eroded. The sand resulting from these two causes has accumulated along the shore in vast quantities to be the plaything of the winds, waves, and currents. Besides visible sand, there is that forming the foreshore, the shoals, and bars, and held in suspension in the ever-moving waters.

"To control properly and efficiently this sand is particularly and primarily the object of most of the improvements of the coast.

"A careful study, therefore, of the movement of these sands in air and water is necessary in order to hit upon the best plan for improvement in any particular locality."

The facts as above stated by Major Symons are corroborated by Col. George H. Mendell in his discussion. In the paper he states: "The sand is mobile and may be said to be always in motion by wind, wave, or current, and is peculiarly exposed to the action of drifting currents."

On the northern coast of the Mediterranean, both in Italy and in France, a littoral current moving eastward has long been known, and has within the last few years been utilized to protect the toe of the embankment of the railroad between Nice and Genoa particularly. Previous to the application of this plan it was attempted, unsuccessfully, to hold the shore by means of retaining walls and revetments, but now the building of dikes or groins into the sea has arrested the moving sands carried along by this littoral current, and has effectually protected the shore.

The conditions of the Pacific Coast of the United States and in the Gulf of Mexico are quite similar. The Japan current on the Pacific coming from the northwest produces the inshore eddy current of Professor Davidson, moving in an opposite direction along the coast; the Gulf Stream in the Gulf of Mexico moving toward the Florida Straits produces an inshore or eddy current, moving westward along the delta of the Mississippi and as far west as Galveston or Brazos. On the western coast of the Gulf, in the Bay of Campeche, and as far north as Tampico, there is along the coast a prevailing current, which may be called the Gulf Stream current, flowing in around the promontory of Yucatan and hugging the shore. The effect of building works into these currents in the Gulf of Mexico is identical with the effect on the

Pacific Coast, already described—that is, they deposit the moving sands on the side of the works from which the current comes. At the South Pass jetties the sands are banked up on the east or current side of the works for a distance of about 4,000 feet from shore; at Tampico, about 2,000 feet. At the Brazos jetties this effect was also seen; At Vera Cruz, by the closing of the channel through which these currents pass the city of Vera Cruz, a deposit was formed in the harbor.

Even on the Great Lakes, under the action of prevailing winds, there is a littoral current produced, which leads to the deposit of sand if dikes or groins are built out into it. It is the common practice at Chicago, which lies within the influence of this current and wave action, to make a shore by building short dikes or jetties out into the lake.

The general principle, of which the above illustrations are given, is stated by Vernon Harcourt, in his work on Harbors and Docks, on pages 59 and 61, where he states that on most shores the shingle (small gravel) and sand are constantly progressing along the coast. He states that on a straight coast line there is little evidence of this motion, but that as soon as an obstacle is present to this along shore progression, the sand heaps up against the side of the obstacle facing the direction from which it comes, and that this action is frequently availed of to protect shores against erosion by the projection of groins of timber, stone, or concrete from the shore, arresting the travel of this material and forming an artificial foreshore in front of the coast. After giving several illustrations along the coast of Great Britain of this moving material, he states that the sand washed from the coast and also produced by the destruction of the shingle is conveyed much farther, and, owing to its lightness, is readily affected by the slightest influence of wind, wave, or tidal current. In the English Channel it is carried by the more powerful northeasterly current through the Dover Straits into the North Sea, where the current, expanding under the shelter of the French and Belgian coast, deposits its sands against any obstacle in its course, and that the jetty harbors of the North Sea, when projected from the shore, act like groins and arrest the traveling sand, which causes a progression of the foreshore. The sand-bearing current finds also sheltered places in the estuaries of the Scheldt and the Maas, where it leaves its sediment. The fact as to the latter place I can corroborate from personal examination.

I am confirmed in my opinion, both from my own experience and from study of the subject, that if, for instance, the straight jetty at Tampico, 7,000 feet in length and normal to the shore line, had been curved in the same manner as was proposed by the Board of 1892 for the breakwater at San Pedro, the entire area inclosed would in a short time have been entirely filled to the surface of the water by the accumulated sands moving in the ordinary littoral current, which I believe to be no stronger and to carry no more sand than the current along this part of the coast of California. I believe also that should a solid pier be built out any distance in Santa Monica Bay, there would be formed a deposit on the eastern side of it and a progression outward of the foreshore. But there would be no shoaling in the half a mile of harbor width between the end of the piers and the breakwater. The present depth would not only be maintained, but would probably be increased by the scour of the littoral current around the ends of these solid piers. This is the reason why open or pile piers is the proper construction to extend into this bay. There were made some examinations in 1894 of the effect of this coast current upon the bottom of the bay at the pier of the Southern Pacific Company, and I found there had been a slight deepening between the bents of piles, probably equaling in area the construction of the bents themselves, and later soundings show similar conditions. For this reason I think it can be safely predicted that open pile piers allow sufficiently free movement to the coast current to prevent any deposit.

The description of these conditions given in a memorandum by Professor Davidson in a letter to the Board of 1892, bound volume II, page 105, is applicable at this point. The two following quotations refer to San Pedro Bay:

"The bay is the northwestern limit of a very extensive plateau of comparatively shoal water along the seaboard from Point Firmin to about Newport, and the whole country behind the shore is sandy and so low that in winter it is flooded for miles inland by the rains and the overflowing of the low banks of the numerous streams frequently changing their courses. The detritus from these streams is moving seaward and principally to the westward over this plateau and helping to extend it by the action of the inshore eddy current."

Again Davidson says: "With the chart of the Coast Survey before us, we [General Alexander and himself] have drawn rough lines of the suggested breakwater to cover the exigencies of vessels entering the harbor from the west or around the exterior extremity of the breakwater, and to give free movement to the inshore eddy current carrying its material to the westward."

The current in Santa Monica Bay was, he says, sufficiently strong to cause the surveying vessel to ride to the current with a strong westerly breeze blowing.

The existence of a northerly current at the entrance to Wilmington Harbor is

plainly indicated by the hydrographic chart accompanying Senate Ex. Doc. No. 61, Fifty-third Congress, third session, being the report of Colonel Benyaured, dated February 7, 1895. He states on page 3 of that report:

"The approach to the entrance is from the southeast, and the deeper channel is around the end of the east jetty. All the study charts show the channel in this position, and from observations made from a number of floats I am of the opinion that this channel is due to the flood currents; on the ebb the floats took the direction straight out and about parallel to the general direction of the jetties and toward Point Firmin."

On all jetties where I have had experience or have examined or studied, this result occurred. It is not necessarily the flood current, but the coast or littoral current flowing in this case north and westward, backing up against the east jetty and flowing round it and cutting into the obtruding bar; the contours then show this current to be moving off this point toward Point Firmin, and the ebb currents coming out of the harbor of course take the same direction, crowded by the littoral current. The existence of this current is further shown by the following facts:

I am reliably informed that at Wilmington the effect of the northerly or westerly current along the coast was plainly indicated when some years ago the material dredged out of the Wilmington channel was dumped from the scows in the easterly angle of the jetty; it was found that this material was washed back into the entrance channel at the end of the jetties, and it was necessary to find some other place farther out at sea for dumping the material. If the contour map of San Pedro Bay be examined, it will be seen that the currents and their depositing action have located the curves of various depths, and that Point Firmin has thrown these curves outward. In my opinion, if a breakwater connected with Point Firmin should be projected, as it has been proposed, about three-quarters of a mile farther out into the sea, there would be restored what were probably ancient conditions before this point was washed away by the action of the waves and currents, and that all of the contours would move out this additional distance of three-quarters of a mile, or, in other words, would make a deposit in the protected harbor about 4 fathoms, or 24 feet, in depth, and that in a comparatively brief period. One of the engineers, Mr. Hawgood, who appeared before the Senate committee in advocacy of a breakwater at San Pedro, criticised, and I think correctly, in 1895, in a discussion before the Engineers and Architects' Association of Southern California, the plan of the Board of Engineers of 1892, and he considered this depositing action of sand of sufficient consequence to propose an inclosed harbor by the building of an arm corresponding to that proposed to be built by the Board at Point Firmin.

The very serious dilemma in which the two Boards of army engineers found themselves in designing a breakwater at San Pedro was fully discussed by myself before the Senate committee on June 19, 1894, and I will, in order to save time, refer the Board to my discussion of that subject on pages 5 and 6 of bound volume IV, being copy of remarks made before the Senate committee; in other words, the first Board, recognizing the great advantage of having two openings for navigation and to be used alternately for entering the harbor under various wind and wave conditions, and also to afford a free movement of sand-laden inshore currents, left an opening which the second Board believed would be productive of very serious disturbance to the harbor to be protected, and this second Board chose to take the chances against the silting up of the harbor and proposed to connect their dike with the shore. The great disadvantage of having only one opening for sailing vessels for entering the harbor is understood by navigators, and I have no doubt they will agree with the opinions of the first Board on this subject. I think the dilemma in which the Board found themselves can not be more forcibly stated than in the discussion of this part of the subject by Senator Frye in his speech:

"It is called the inner harbor; it is the inner harbor of Wilmington which has been talked about. The harbor which it is proposed to make at San Pedro is here [indicating]. Now, here is a remarkable fact to be noted: The first Board of Engineers found that if a breakwater were attached to the shore and run 8,000 or 10,000 feet from shore, the harbor made by it inside would certainly fill up with sand."

And then he refers to civil engineers whose names I will not mention. So the three army officers and the two civil engineers agree that if a breakwater is so attached and extended from the shore the harbor will fill up.

"What did the first Board do? They provided for that reach of breakwater, then an open space of 1,500 feet right in the harbor, then a breakwater running off in this direction [indicating]. Which is the direction of the southwest winds? There it is; Senators can all see it. Exactly straight into the 1,500 feet the first Board of army officers left open. Is there any safety in that harbor? Can any ship lie there in a heavy southeast gale when southwest waves are coming in?"

"How happened it that the army Board of Engineers made such a blunder? It happened simply because they did not know that a southeast gale on shore was accompanied by a southwest wave line from the ocean. That is all. They made a

profound mistake because they did not make the necessary inquiry. There is not a Senator on this floor who does not know that they made a mistake. There is not a Senator here who can not see that if they had made it on purpose to receive the southwest wave line they could not have placed it in any better position. There it is, right straight in." (See p. 1, Senate discussion.)

Fifth. The holding ground for anchorage at Santa Monica and at San Pedro is shown by the results of borings to be clay, sand, and gravel with some limited rocky areas cropping up at the latter place. The profiles of borings and of the pile-driving record at Santa Monica illustrate the kind of material found on the bottom of these bays. The details in regard to this feature of the subject will be more fully stated by others better able to discuss it.

Sixth. The examinations made by the Board and the charts and photographs all show that there is no suitable space for even one railroad track under the wave-washed bluff at San Pedro, but that at Santa Monica there is ample room for any desired number of tracks in addition to those already existing. With the provision in the act itself requiring the Southern Pacific Company to make satisfactory arrangements for other roads to enter on or cross its tracks and right of way, and as the president of that company has offered to build for \$10,000 per mile ten more tracks, there need be no further discussion of this subject; further, an examination of the proposed harbor at San Pedro and the location of the two railroads there will show that the Southern Pacific has entire control of the only possible approach to the projected harbor, and that the tracks of the railroad on the east side of the river, the Los Angeles Terminal Railway, can not reach the area under this breakwater without crossing the entrance channel to Wilmington Harbor. It is very doubtful, even if this were practicable, whether the Federal Government would permit a draw-bridge to be built at such a place. Mr. Hawgood, in bound volume III, explains the situation very clearly, and the following is quoted from page 7 of that exhibit:

"It is also materially deficient in facilities of establishing railway communication with the anchorage. On the west side only could direct connection be established between ships and railway. That side is now fully occupied by one railway, and it is not practicable with any reasonable expenditure to give access to another. There is no more available room than that needed for the business of one road. From the north end of the town of San Pedro, at Bosky or Smiths Island, to the shore end of the breakwater, and beyond, the bluff is 60 feet high. All the narrow shore from Bosky to near Timms Point is full of tracks now. From Timms Point to the breakwater, with a small exception, the waves break at the foot of the bluff, with full exposure to the southeast. To cut away the bluff from Bosky Island toward Timms Point would bring down part of the town of San Pedro, while construction from there along the foot of the bluff would be undesirable on account of grades and complicated as to right of way. The position is such that as a business proposition one road only, the one that now occupies the west shore, could reach shipping by wharves. All other roads would have to lighter to and from deep-draft ships. A harbor of such restricted accommodations would not answer public requirements.

From these physical and commercial conditions the only free deep-water harbor possible is at Santa Monica, Port Los Angeles. That at San Pedro is almost inaccessible, and in any event the approach for railroad purposes would be very inconvenient, expensive, and restricted.

At Port Los Angeles there is sufficient room along the entire distance of nearly 2 miles between the canyon east of the wharf and the town of Santa Monica to establish a great yard for handling cars on and off the piers of the various railroads which may utilize the protected harbor; or the canyon itself may be used for the purpose and a suitable ascent out of it to the high plateau may be provided.

And as to the tunnel at Santa Monica, about which we hear so much, what is that as an obstruction to such roads as the Southern Pacific or the Santa Fe, or any other great transcontinental line?

All of the above discussed six points have already been very ably stated by Mr. Hood in documents already in your hands. (See bound Exhibits A, B, C, and D.)

Seventh. Another important advantage at Port Los Angeles is the existence there already of a deep-water pier projected into the harbor to be protected, and the use of which the owners are obliged under the law to share with other companies. At San Pedro there is nothing whatever in the proposed harbor in the way of commercial facilities. On the large map exhibited is a suggested plan for sufficient wharf facilities for many years to come and for several railroads. These piers would be protected by a breakwater located as shown on the exhibited map. One of the engineers of the Board of 1892, Colonel Hains, expressed an opinion before the Senate committee that this breakwater would protect these piers.

Eighth. Experience has proven that the favorable nautical conditions at Santa Monica make it entirely practicable to load and unload vessels in almost any weather without inconvenience, delay, or damage. A large number of statements of shipmasters that have used the Port Los Angeles wharfare referred to. (See Exhibit 37.) Also a digest of affidavits of shipmasters testifying to these favorable conditions,

given on pages 63 and 69, bound volume VI, being the report on hearing before the Senate committee. I also submit a number of statements made by shipmasters and others recently compiled. Some of these shipmasters and nautical experts will appear at the proper time before the Board to give their testimony to the superior advantages of Port Los Angeles.

Ninth. Most of the coastwise business, both passenger and freight, is between the city of Los Angeles and San Francisco and other northerly points. Santa Monica is 35 miles nearer these points than is San Pedro. On all business requiring quick delivery, or where time is of any importance, Port Los Angeles has great advantage. Mr. John M. Crawley, assistant general passenger and freight agent, Southern Pacific Company, addressed a letter to me at my request for information of what time would be saved to passengers and freight by using Port Los Angeles instead of San Pedro. This letter is filed under bound Exhibit 1. It shows that practically nearly one entire day is saved; this difference is based on the usual running time and the average time for unloading cargo, assuming that each port would have the same amount of cargo and that the facilities for unloading from ship and loading into the cars are as good at one point as another. I need only refer to these commercial features and to the amount and character of the business that is regularly done at Port Los Angeles. A complete statement of every ship that has done business at this port during the last year will be filed with your Board and will show that the business is a deep-water harbor business in the broad sense of the term. Mr. Hood has this information in hand for the Board, also about sailing ships around Cape Horn.

Tenth. I think that it may be stated that the successful experience in transacting commercial business for about three years at the Port Los Angeles pier makes it evident that even if a breakwater were built at San Pedro and not at Santa Monica, the principal commercial business of southern California would still be done at Port Los Angeles.

Eleventh. In reference to the comparative cost of a breakwater at Santa Monica and San Pedro, the greater exposure at the latter place would necessitate a section much larger than at the former, the rock or the concrete blocks to be of greater size, the slopes flatter, and the work generally much more expensively constructed. I believe it to be a safe estimate that the cost to accomplish the same purpose would be one-third greater at San Pedro than at Port Los Angeles, and as to the establishment of piers immediately behind a breakwater at San Pedro and connected with it, or the laying of a railroad track or tracks on the top of such a breakwater in such an exposed situation, is in my judgment entirely impracticable, and even if built can not be successfully operated with the waves almost constantly breaking over it.

A similar plan was proposed and attempted at Colombo Harbor, Ceylon, but had to be abandoned as impracticable, although the usual waves are only about 10 feet in height and the top of the breakwater was 10 feet above high water, as was proposed by the Board of 1892 at San Pedro. I have seen a photograph of a wave and its spray at the Colombo breakwater which reached a height of over 60 feet.

Twelfth. Objections have been made to an isolated or detached breakwater at Port Los Angeles. Major Raymond, in his testimony before the Senate committee, said that he did not recollect any similar breakwater. As I had seen several such breakwaters in Europe and in this country, I had an investigation made the results of which I am glad, in the way of general information, to submit to the Board. The list comprises thirty-three detached breakwaters, the description covers thirty-eight typewritten pages, and there are five sheets of sketches showing locations and cross sections and material. Thirteen of these breakwaters, five in foreign countries and eight in the United States, are practically parallel to rectilinear shores, and there is nothing in the reported history of these works to show that they have not performed the purpose for which they were constructed. There are a sufficient number of these detached breakwaters in various parts of the world parallel to rectilinear shores to lead Mr. Vernon Harcourt, in his book on the subject of harbors and docks, to consider them a type of harbors, and on page 80 we find the following:

"In the second type the detached breakwater forms and shelters the harbor, but instead of stretching partly across a natural bay (as his first type does) it runs parallel to a straight line of coast and protects a series of molds or jetties, projecting at right angles from the land."

This comes as near describing the exact conditions at Santa Monica as could possibly be written.

I have now presented briefly the promised proofs of the superior advantages of Port Los Angeles. These will be elaborated, amplified, and extended by other witnesses more familiar with the details of the physical and commercial conditions, and more experienced in dealing with them. I have drawn the outlines of the argument, others will fill it in, and demonstrate to your entire satisfaction, if I have not done so, that the deep-water harbor should be located at Port Los Angeles.

Senator COLK then addressed the Board as follows:

Mr. Chairman and gentlemen, I need not state that I am very much surprised to be suddenly called on to present my views on this question. I have not here the

Coast Survey maps or charts that I expected to have before I made any presentation of the case, but as they are already here in another form perhaps it would be as well to say what I have to now on the subject as well as at any other time.

I would like very much, however, to have a map of Los Angeles County, if there is one to be had, for I differ a little with the position that was taken here, or the remark that was stated here, that it is a matter that concerned only the people of the United States. I take the view that it concerns particularly the people of this great city of Los Angeles. Let me state this, that in my opinion if it were not for the presence of the city of Los Angeles here this application would not be made, and you, gentlemen, would not be sitting on this question. I am clearly of the opinion that the inducing cause for creating a deep-sea harbor is the city of Los Angeles, and that it is mainly for Los Angeles, or on account of the city of Los Angeles, that the work is to be undertaken, and not for the present either, but for the future. This is a work that will be of use for a long time in the future. It is not a work for to-day or to-morrow, for five, ten, or twenty years, but a work evidently for hundreds of years. But suppose it be considered a work for forty or fifty or a hundred years in the future, that fact should be considered at this time.

Now, gentlemen, it was stated here that the commerce of the city of Los Angeles could be transacted with the present facilities. I believe it. Here is Port Los Angeles, which has proven to be of more utility than anyone ever expected as a harbor. Here is the port of Wilmington, with which I have been familiar for a great many years, for I believe it was through my influence and at the request of General Banning that the first appropriations were made for the improvement of the harbor at Wilmington, but that, gentlemen, was before Port Los Angeles or before a harbor at Santa Monica was ever thought of. Then, this work is not only for the future, but for the business of a port; it is for the business that will be transacted through a port, for a port which opens up the whole Pacific. It will be, as we believe, a port in which will be transacted the commerce, or a large part of it perhaps, of China with America, or Japan, or Australia, the Sandwich Islands and Polynesia; unless the Nicaragua Canal cut it off, the coast of South America and of Mexico. At all events it will be a port for use in the oriental trade. Now, we are, as I claim, considering the necessity of a harbor for Los Angeles and not for San Pedro. I am not a railroad engineer, but I know some of the ideas that are entertained here by railroad engineers and railroad men. Let me state that, in my opinion, if San Pedro is selected for the outer harbor, and for the business of a port, that it will be largely, as stated, for the benefit of other parts of the United States. In southern California we have now only a quarter of a million people, and in other parts of the United States some seventy millions. The population here at the time this harbor is completed might run up to a half million and the population of the United States to a hundred million, and largely the commerce transacted at this port, whether it be Santa Monica or San Pedro, would be in connection with the East, and if you make that harbor at San Pedro, and we will suppose that the contention of the friends on the other side and of some of the members of the chamber of commerce is correct, and that a good harbor can be made, the best kind of a harbor at San Pedro, and we will suppose the harbor to be made there in which will be transacted the commercial business; if that's so, the next idea will be to carry that commerce to the East, and the first and natural opening is San Geronimo Pass, and if I understand the object of most railroad engineers, it is to reach the objective points by the shortest lines; and will they tell me what object there would be in that commerce coming to Los Angeles and then on, instead of striking across the Anaheim and so directly to San Geronimo Pass? The proposition of the other side and of the members of the chamber of commerce seems to me to entirely side track and not come within 20 miles of Los Angeles. We know they seek the shortest lines always in railroad extension. If I had a map of Los Angeles County here, you could see that San Pedro, Los Angeles, Puente, and Spadra on one of the lines of railroad to the east stood very nearly on an equilateral triangle. Should the business pass over two sides of the equilateral triangle instead of one, the eastern part of this great portion of California would be cut off. If their proposition is not to side track Los Angeles, I don't know how it can be interpreted. Not that that is the aim of any of them—I would not charge that upon them—but that will be the effect, in my judgment.

I do not know where a line running directly from San Pedro toward San Geronimo Pass would strike that pass. But certainly it would be far west of Los Angeles. We are now north of the proposed harbor, directly north of the outlet to that harbor by railroad, and San Geronimo Pass is east of this harbor. Suppose, then, we have two legs of a right angle triangle, one leading from San Pedro to Los Angeles and the other from Los Angeles to San Geronimo Pass—but then, perhaps, the railroad would go through Cajon Pass—and so strike across where the railroad now runs. I am speaking now of the future possibility of railroads—they have not stopped building railroads yet in this country—and suppose they pass through, that same argument exists so far as Los Angeles is concerned, and they would strike

across 20 miles below Los Angeles to reach that pass as well as the other, and I do not know that there is any practical line leading to the east that is better than through San Geronimo Pass, or perhaps the one to Cajon Pass; but we know that this commerce will seek the quickest, easiest, and best road out from the port to its destination, and probably its destination is the nearest water on the Atlantic side of the ocean, perhaps the Gulf of Mexico, Aransas Pass, Galveston, or New Orleans, and it will go by such route and will go through the pass—one of the passes I have mentioned—and in all probability through the San Geronimo Pass. This, in brief, is my view of the matter. I think it is sustained by the facts, and if I had a map of this county with the railroads already built, I think the Board would see that it is not merely a pretense on my part, but a reality.

The CHAIRMAN. Senator, we want to confine ourselves to the relative merits of these two places to which, under the law, we are confined. These interior connections while they are of interest, are, of course, outside of our province.

Senator COLE. I am aware of that, but I thought this might be a consideration with the people of Los Angeles.

The CHAIRMAN. We do not want to tie you down too closely.

Senator COLE. I think the city of Los Angeles is entitled to some consideration, other things being equal. But now as to the question of equality, I will leave that to the engineers; I will not go into a scientific argument. They will present that to you, and it has been already presented to you very ably by Mr. Corthell.

Then as to the relative merits; but first as to the hydrographic character of the two places as to the facility for building a harbor. That was stated to my mind very clearly by Mr. Corthell when he showed that the floor of the ocean here, as stated by Professor Davidson, is gradual, only going a little deeper out for the outer harbor, whereas, at San Pedro, according to the Coast Survey charts, there are within this harbor here rock bottom, represented in the Coast Survey large areas in the harbor of rock bottom, and the kelp shows that fact, but there is nothing of that kind to interfere with the harbor at Santa Monica. There is not the rock bottom that is to be found in the harbor here. The Coast Survey charts represent that specifically and definitely.

Now, I have the greatest estimation of Professor Davidson's ability, but it struck me that his opinion upon which he decided or recommended San Pedro on one occasion from a trip made by him in 1852 from this point on the coast to Point Dume and back again he presented his facts mainly upon that before Santa Monica was known. Professor Davidson seemed in his statement all the while to compare the condition of the harbor, condition of the winds in southern California with those away up north, speaking as he does of Point Mendocino and Coos Bay in the Columbia River, and those points up there, and we know the severity of the storms there.

There is one person who is better calculated to judge of the subject in my opinion than any other. I refer to Commodore Taylor, who made the hydrographic surveys of these points, who has the definite and positive information derived from actual, careful, and long-continued study of the subject. And let me state here that, in my judgment, the opinion of a naval engineer, or of civil engineers whose business it is to consider the hydrographic condition of the locality and to consider the fitness for a harbor, is much better to be relied upon than that of military engineers, who, as stated by General Craighill, were fortification engineers and not hydrographic engineers. They were not, as he said, riparian engineers, but they are fortification engineers. As stated by Mr. Corthell, the whole of their argument—nearly all of the argument—is based upon the ideal fortification. We are not seeking a harbor for fortification. It is commerce we are after; it is oriental trade; it is the trade of the Pacific we are looking to.

Let me state further that this idea of defense all the while in the minds of those people, when the military engineers had the matter under consideration before, relates largely to Wilmington Harbor in the matter of defense.

While they had their mind upon defending Wilmington Harbor I should think they expended say a million dollars in various appropriations in different years for improvement of the harbor.

That is the whole argument. Then, as I stated before, the opinion of civil engineers, of naval engineers, and particularly of the hydrographic engineers who have examined these localities is to be relied on certainly more than the persons seeking for defense or fortifications. To be sure, the military engineers are as able as any, but then in making a harbor they always employ civil engineers, always do it, and when they follow their own judgment too closely it has not been infrequent that mistakes have been made by these military engineers who have had charge of rivers and harbors.

Now, then, as to the prevailing winds, and I wish to impress this upon you, gentlemen, the dangerous wind upon this coast is the southeaster that sweeps up the coast with a clean sweep from San Diego, and that is the real cause of the numerous wrecks that have taken place at San Pedro. They have been caught behind Point Firmin;

it has been impossible for them to get out. Numerous wrecks of vessels have taken place there, and a list of them will be found in the report of one of these harbor commissions. But the vessels are, some of them, the *Adelaide Cooper*, *R. P. Buck*, *Kennebec*, *The Amy*, *Caylor*, *Frank Austin*, *Respicadero*. It is stated here that they were wrecked behind this point when the southeaster came.

Now, as to the anchorage ground, and I refer now also to the report which I have, which has been printed, and the testimony of Mr. Calor, Mr. Muir, and several others by which it will appear that the anchorage ground at San Pedro is off here on this ground. The Coast Survey map would show the depth of water and the reports will give the position north of Deadmans Island where these vessels were at anchor at the time. They were driven in almost every instance east of southeast, or southeast and east, so you will determine without any difficulty the holding ground not behind the proposed breakwater at all. When they have been caught here in a southeaster it is almost impossible for them to get out.

Then another point, and I didn't understand Mr. Corthell very clearly to mention it, but these hills are extended off in this direction, and they stand as a wind-break against the southeaster which would otherwise strike into the bay of Santa Monica. There is nothing here to prevent the southeaster going straight into San Pedro Bay. These hills are 1,500 feet high. Then there is a range of hills along there that is not down on the map, the Cienega Hills.

Question. How high are those hills?

Senator COLK. I am not able to give that. There is a considerable of an elevation along here, which serves a very considerable protection, in my judgment, to vessels running in the port of Santa Monica, and out here in San Pedro Harbor there is no such protection. The wind strikes fairly into that harbor. It is utterly impossible to make a safe harbor at this point, for while you can make a breakwater you can not create a wind-break by any artificial means. In addition to this, these two ranges of hills are better than any artificial protection.

Mr. HOOD. I wish to say, Senator, that although we are very much interested in this matter, the chairman has given us three or four days to present this matter, and if you could give a chance to another witness when you have finished your remarks—

Senator COLK. I will not detain you any longer. The real contention in my view of the case concerns the city of Los Angeles more particularly, and there are others who can present the scientific and hydrographic questions better than I can.

Mr. HOOD. Mr. Chairman and gentlemen of the Board: After Mr. E. L. Corthell's presentation of the subject, I will endeavor to touch as lightly as possible on any matter which Mr. Corthell has handled, as it certainly would be superfluous on my part to do otherwise, and especially in view of the fact that I, myself, was rather surprised when I heard how this Board was to be composed—the names of the gentlemen composing it. I was surprised that a public hearing was to be given at all; it seemed to me entirely unnecessary, for the parties who have heretofore advocated the respective merits of San Pedro and Santa Monica bays for a deep-water harbor whose advocacies have been before nontechnical boards. But as the wish has been expressed that there should be a presentation, that leaves me in the position of being obliged to do it. I will condense as much as possible. I can really hardly talk. I would like to ask now to file to-morrow certain charts and profiles bearing on the subject which I have not with me at present, that I may be allowed to do so.

The CHAIRMAN. You can put in anything up to the time you close your case.

Mr. HOOD. I think, perhaps, the better thing for me to do is to give a very short account of how we happened to obtain the proposition to build a wharf in the proposed deep-water harbor near Point Firmin, and incidentally give, in the course of this account, such few facts as might possibly be of interest.

Some years ago—the date I don't remember—as Mr. Corthell mentioned, the breakwater was proposed to be built by Colonel Mendell. At that time there was no commerce whatever in Santa Monica Bay so far as I know. There had been a wharf built by Senator Jones at the town of Santa Monica, near its easterly limit, but that had long ago been taken down by the company that I am connected with, as it was dangerous—it was worm-eaten and useless. When it was known to the Southern Pacific Company at that time—I think the Southern Pacific Railroad Company, but I not certain—that it was probable that a breakwater would be constructed near Point Firmin—at that time the Southern Pacific Railroad was the only railroad, I think, at San Pedro. At that time the area shaded on this map in red was acquired by the Southern Pacific Railroad Company, and the area shaded in yellow was acquired by the Pacific Improvement Company and some outside parties. The yellow tract was acquired purely for real estate and speculative purposes; the red tract was acquired for station purposes. The exact status of the title I will take the liberty, with your permission, of filing with you, as a memorandum, open to the inspection of anyone you wish. But I will say, in general, that the Pacific Improvement Company owns at present a seven-eighths undivided interest. You will see from

that, as has been before remarked, that it comes pretty close to a monopoly harbor, although, as everyone knows, the right of way can be condemned by another railroad across the property of any railroad, if the public interest requires it. Sometimes it is disagreeable. At that time we very heartily started to build a wharf, heading out directly to the deepest water, and then commenced studying the business end. We knew perfectly well that lighters lying to the eastward, that in unloading coal into them the coal would often land in the bay instead of the lighter. We recommended to the Government engineers—called their attention to it—the advisability of closing that westerly entrance of the proposed breakwater because the heavy swells will come in a little different direction from the ordinary swell and would strike into that opening still worse than the ordinary swell would, and it is quite obvious, under those circumstances, that wharves must be built so ships shall lie head-on to the swell. This would make a very peculiar set of wharves, as you gentlemen will notice.

I think that the question of storm waves and storm winds has been very correctly stated so far by Mr. Cortell.

I was then directed to see if there was any suitable place to build a wharf in Santa Monica Bay. We were influenced by the Pacific Coast Steamship Company, who said it was expedient to have a better approach to Los Angeles than San Pedro. The Pacific Coast Steamship Company said the farther we could go west from Santa Monica the better we would be protected from the ordinary swell at Point Dume, and we were further induced by the fact that as this country increased its population and prosperity a small wharf was built at Redondo, and unsafe as that wharf was we found we lost our coastwise business at once. At that time it was forced upon our attention that an ocean pier built anywhere but as far to the northward as possible would perhaps do ocean business, deep-sea business, but it would lose the coastwise business. As you are aware, the principal coastwise business is to and from the north. In other words, we didn't care to make an investment such as was necessary to build a secure ocean pier at San Pedro and get an entrance to it for a coastwise business and only get a few deep-water ships. That is true of any other corporation that ever came into this country; true of the Santa Fe, which has a track now at Santa Monica; it is true of every corporation that will ever come to build railroads. In order to combine coastwise and deep-sea business we must get to the north as far as practicable. The reasons for locating, as I said before, the wharf in that precise situation were the protection afforded by Point Dume and the deadening effect of the Cahuenga Range, and a very important feature which has been overlooked by the army engineers, of whom Colonel Mendell was the chairman, that for the most economical construction of a breakwater, to obtain the greatest area between the 4-fathom line and any line upon which it is considered to be expedient to locate the axis of the breakwater, it is quite necessary that the point selected should be where the fathom curves are separated the farthest horizontally. If you will examine the chart on file, the Coast Survey chart, examine the reports of the Boards of army engineers, examine every one of the charts, you will find the position of Santa Monica Bay shown on this large map as being the position of the proposed breakwater, meets the condition of having the greatest horizontal distance that exists between the 5 and 7 fathom lines, in Santa Monica Bay, which will obviously give the greatest protected area for a given length and height of breakwater.

These were the reasons which induced the Southern Pacific Company to direct me to examine the question. As the result of it the pier was built, and I would like to say candidly that I was very much scared. I did not know as much at that time as I do now about the winds and the waves in Santa Monica Bay. I tried to build a pier to stay, and it stayed. I think we built better than was necessary. In reference to the situation of the respective proposed breakwaters of San Pedro and Santa Monica bays, with reference to the accessibility under sail with winds blowing in any direction, I wish to say nothing. To the chairman of your Board, the gentleman that he is, holding the position that he does, certainly I should say nothing under the circumstances.

I would also like to say something about the anchorage regarded as a holding ground in San Pedro Bay, as will be shown on the blue prints which you will kindly allow me to file with you to-morrow. We know very little about the holding ground absolutely other than what we know from the opinions of the master mariners, but we do know something about the character of the ground in the line of the wharf which we started to build and abandoned for the present, as we have a line of borings carefully taken out in the direction somewhat as indicated by my pencil, and you will find when you see these profiles that the holding ground outside of a thousand feet, more or less, so far as my judgment goes, is good. That is my judgment to about the 4-fathom line. The clay is pretty stiff, but farther out it is better and seems to have a layer of mud over it. It is my opinion that the holding ground in San Pedro Bay is very good, especially good if a breakwater is successfully constructed, because then the ships would not be exposed to waves. But it is well

known that there are more or less rock ledges in the bay; for instance, there was discovered by Colonel Gillespie and his assistants a rock with 18 feet of water over it in 1887, and as their soundings were not very much in detail they were not sufficiently in detail for that purpose, and it is quite possible that there are other rocks; the existence of this one rock shows that. The fact that sometimes their anchors catch in the rocky ledges shows that there is some rock in there, but I do not think there is enough to amount to anything. It is supposed by some parties that the existence of kelp in the bay indicates rock. It does; it indicates some mineral substance of suitable size and shape. It may be a large claim; it is generally rock, but the kelp is indifferent as to whether the rocks are a large ledge extending 30 or 40 miles or rocks of small size. Now, the only objection that I see to the numerous beds of kelp which are shown on this blue print, you will notice that there is a great deal of kelp shown there, an exceedingly large area of kelp shown on the ground or space in which ships would anchor between the outer ends of the wharves and the breakwater. Now, I do not think that that, to any extent, indicates rock bottom, and you will notice that it is very easy to confirm this by having the proper parties try to pick up some of these. So that I would furnish two objections to this kelp, first, the bottom of an ocean that is pretty well studded with small gravel and cobbles is hardly the best holding ground, and the rather serious objection as illustrated recently by the rather serious accident to the Pacific Coast steamship *Coos Bay* between here and San Francisco, which is reported to have fouled her propeller in a kelp bed and was so damaged that the steamer *Santa Rosa* had to tow her to port. We are willing to concede, in fact we claim, that the holding ground in San Pedro Bay in the area heretofore proposed to be protected by a breakwater is good enough, as good as I should want myself, and I wish to impress this upon you, because it may save you the annoyance of a good deal of testimony on this subject.

Of Santa Monica and the vicinity of Port Los Angeles wharf, to a point nearly opposite the center of the town of Santa Monica and well out into deep water, there is a Coast Survey chart, the original tracings of which were signed by Prof. George Davidson, who was then in charge of the coast survey work on this coast, which I have always admired. I think it is one of the most beautiful examples of thoroughness of work I have ever seen. Now, on this chart there is absolutely no kelp in the area proposed to be protected by the breakwater, excepting what is inside the 4-fathom line. Now, my opinion is that you can find some isolated pieces of kelp outside, but not enough to be noted on the Coast Survey chart. Kelp has a way of dragging its anchor, and in certain conditions of wind and wave will move. Now, all the anchorage ground has been shown as free from kelp. This will indicate, I should think, that there was not a very great amount of hard material on the bottom, and therefore the anchorage was probably fully as good as shown by the borings which we made.

Second. From the mouth of this canyon, which is known as Santa Ynez Canyon, for certain reasons which I will explain later, I will file a profile of these borings and a sketch of the position. These borings show absolutely good holding ground, and it seems to me that the subject is not worth discussing any longer. There is good holding ground at both places without a breakwater and with a breakwater—almost anything is good holding ground.

The CHAIRMAN. The hearing stands adjourned until 10 o'clock to-morrow.

SECOND DAY.

DECEMBER 22, 1896.

The Board reconvened at 10 a. m., all members being present.

The CHAIRMAN. Mr. Hood has the floor.

Mr. WILLIAM HOOD, chief engineer of the Southern Pacific Company, spoke as follows:

Mr. Chairman and gentlemen of the Board, with your permission, I will continue from where I stopped yesterday. I will say in the beginning, to facilitate the matter and occupy as little time as possible, that with your kind permission I will be exceedingly brief, giving in fact more of a summary than anything else of the principal points, and, as arranged yesterday, will file with you, for the inspection of all parties, the essence of my remarks, which will differ only from those which I have delivered here in being more amplified.

When we were constructing the present Los Angeles Wharf at Santa Monica Bay, it was our opinion, before we had any experience, that we could hardly expect to berth ships at the wharf continuously throughout the year; and also that there would be considerable difficulty at times when we did berth ships. For that reason we put in a very elaborate system of buoys, anchors, and moorings, with the idea of resting ships off during times when they would be likely to injure themselves and the wharf, due to undue motion, and also that possibly we would have to move ships off from the wharf and anchor temporarily. We were a good deal surprised to find

that the necessity for anything of this kind was exceedingly rare, and it has been very satisfactory to find that. It is quite evident, as everyone knows, that the Port Los Angeles Wharf was built exceedingly strong, to withstand quite a heavy sea. We had no ambition to have a large expenditure of money wrecked; but it is also obvious that when a breakwater is constructed protecting that harbor, that wharves can be built with very much less strength and cost of construction, as there will be no possibility of their being obliged to withstand any such exposure as the wharf at present.

I will remark here that at the proper time I intend to present, as bearing on this subject, Mr. J. A. Muir, superintendent of the Los Angeles Division of the Southern Pacific Company, who will present to you a full account of any trouble or difficulty that we have had at the wharf, so far as he can remember such troubles—for instance, the trouble of quite a moderately serious nature that we had on March 2 of this year with the ship *Dunboyne*. Also, if there is any information that other parties have as to difficulties that we have had there of a minor or greater character that Mr. Muir may omit to present, owing to not having them in mind (he having very numerous and important duties requiring his attention outside of this Port Los Angeles Wharf matter), I certainly hope that at the proper time anyone who has any information on that subject will present it to the Board with your consent.

It is very satisfactory to us to have had some trouble of this character. It demonstrates that although Port Los Angeles is a remarkably good harbor in its present condition, it still requires a breakwater to make it entirely secure at all times to give confidence to owners of ships. I will present to you, with your consent, in closing, certain blue prints which lie on this table, some of which are in duplicate—some of them four copies, some of them five copies—both for the use of the chairman and members of the Board, and if you will consent, for the use of anyone else who wishes to inspect them. I will say further that if it is desired by you, I will furnish to the Board, and to anyone else, as many copies as may be desired of any blue prints, or data of any description that can be thought of that is now in our possession, and I think we have perhaps more complete data of that kind than anyone else at present.

Among the blue prints will be a blue-print profile, which we have made for our own use and of which we keep up the original tracings from time to time, showing the pile penetration into the bed of the ocean at the Port Los Angeles Wharf, showing the character of the ground or soil through which the piles penetrate, showing the depth of penetration of piles in as much detail as I think can possibly be required, and also showing the result of soundings which we have made from time to time along the wharf to determine whether, as the effect of its construction, the water is shoaling under the wharf or deepening. I will say, in general, that it is slightly and continuously deepening so far. This all bears out to a slight extent the character of the holding ground which I had up yesterday. And, as you will see by the profiles, we generally get into the blue clay very shortly after passing through, at certain points, a slight layer of sand, and in some instances a slight layer of gravel and sand from the end of the wharf oceanward, after passing through a surface of mud. There is an interesting point as to the continuity of this clay stratum which I would like to mention to you, and it is this: Of course our borings are sometimes 40 feet, sometimes 20 feet, and sometimes 60 feet below the bed of the ocean. I refer to the borings we made on the spot before the construction of the Port Los Angeles Wharf. But we have a rather interesting piece of information which bears on the question very decidedly in reference to the depth of the clay stratum. You will remember that immediately to the westward of the shore end of Port Los Angeles Wharf there is a spur track to a turntable and engine stall and a slight gulch crossed by that track. We were desirous of having good water at Port Los Angeles, as all the water in this whole southern country is ordinarily surface water outside of the mountain ranges, and is inclined to be bad for steam purposes; and I had a theory that if the clay stratum were very thick and we could get through it, it might have underlying it a water-bearing stratum of good water. The consequence was we bored two wells close to the bed of the gulch I have mentioned. The first one we carried down about four hundred-odd feet, the exact depth being given in a memorandum that I will file with you, and then we broke our boring tools and tried others, which is a very common affair in these works. The second well we carried down over 500 feet (I think 532 feet approximately) and the same thing happened to us and we gave it up.

Thus this clay bed, into which the piles penetrated at Port Los Angeles, we know to be at that point more than 530 feet thick, a very extraordinary clay stratum; this being a blue clay with a slight sprinkling of sand mixed with it, and occasionally an indurated nearly horizontal layer. Perhaps it would be as thick as one's hand, but not sufficient to prevent our boring our well as we did, by a water-jet appliance coupled with a revolving cutting auger. It is quite obvious that with a clay body of that magnitude at the shore end of the wharf any rock in the shape of a rock ledge anywhere in that part of Santa Monica Bay, although possible, is highly improbable.

There is an important point to be considered in regard to the commercial aspect of a harbor at San Pedro near Point Firmin, or in Santa Monica Bay near Port Los Angeles, and it is this: Assuming for the moment that wharves for using the harbor commercially would be built out according to some such plan as is indicated on this map to which I point, or any other plan, it is evident that the useful part of the wharf for deep-sea ships is from the 5-fathom line outward, and that all the part of the wharf shoreward from the 5-fathom line is merely approach to the real wharf, excepting that for coasting vessels naturally, after the breakwater is constructed, wharves in much less depth of water will answer every purpose, as is illustrated in the inner harbor of Wilmington to-day.

It will be noticed, by inspection of the charts which are in your possession, that the 5-fathom line at Port Los Angeles is almost uniformly five-eighths of a mile from shore—that is, any wharves built at Port Los Angeles for five-eighths of a mile, the trestle approach or distance of wharf is adapted to coasting vessels only. At San Pedro Bay this curious state of things exists: Between the point at which the proposed breakwater attaches to the shore and the point where the wharf was commenced by the Southern Pacific Company the 5-fathom line is from three-eighths to five-eighths of a mile offshore, with a continually increasing distance of shore until the distance of the 5-fathom line from the point indicated on the map by this pointer, which is locally known as Timms Point, is essentially a mile and three-eighths. That is the only position in the proposed protected harbor at San Pedro Bay which is as well situated in the respect I am speaking of as all the future wharves in the proposed harbor in Santa Monica Bay. The only one as well situated is the one which the Southern Pacific Railroad commenced and stopped work on.

I do not need to emphasize the pecuniary or financial difficulties of filling that space up further with wharves. In reference to the proposition which Mr. Corthell has already mentioned, to utilize the top of the proposed breakwater connected with the shore to go out with tracks on top of same, when it is remembered that the greater part of this breakwater would be in from 6 to 9 fathoms of water at low tide, and that at high tide its top as heretofore proposed would be but 10 feet above high tide, I think I need to say nothing more on the subject. I simply call your attention to it.

There has been a question raised by certain parties, among them the United States army engineers, as to whether a detached breakwater essentially parallel to the shore would properly protect wharves built behind it. Some of the United States army engineers who have voiced their opinion on this matter, say that they doubt it; some others, and others of eminence, say it will be a safe protection, and especially at a point where the exposures are so small as they are at Santa Monica. This subject seems to have been befogged a good deal by technical discussion of it. The human mind is so constituted that it gets befogged easily on such subjects. I think if it had been asked how well wharves would be protected were there an island a mile and six-tenths long and parallel to the shore, the answer would be apparent. A breakwater is nothing but an artificial island.

In reference to properties at the harbor site I will speak very briefly, as I have fully elaborated it in writing. The blue print to which I point, copies of which will be filed, shows the properties of the Southern Pacific Railroad and allied corporations in the vicinity of San Pedro. I wish to say here that there is more property shown colored red as belonging to the Southern Pacific Railroad than we at present have claim to. This shows the original franchisees, grants, and the like. In the inner harbor we have consented to the granting of important franchises to certain lumber and other firms whose business is tributary to the Southern Pacific Company, and to that extent we do not claim or own all of this red-shaded area; but the map was so small that I did not care to cumber it with detail. It is a matter of record and public information and we claim nothing but what we have. We have a fair ownership at the inner harbor. I mentioned it yesterday and will say little further about it, the area being shown at the outer harbor, a portion of which area is included in the original Government reservation, the state of title to which, so far as our claims are concerned, is fully set forth in an appendix, which I take the liberty of filing with you. It is a matter of public record; all these matters are matters of public record.

The map to which I point gives an exact delineation of all the ownerships of the Southern Pacific Railroad at Santa Monica. I need not go into it in detail. From the Port Los Angeles Wharf to the westward for a considerable distance we have also ownerships, as shown in red. This was acquired with a view to a possible future extension of this road around the coast to the Santa Clara Valley, known locally as the Hueneme Plains, which is in the vicinity of our coast road at Montalvo.

Montalvo, as you all know, is near Ventura. It was convenient to get those rights of way at the time we did because they were offered to us and we naturally took them.

I wish to say also, in case the question is raised, as it was once before, that there

is a tract of land known as the Santa Monica Heights tract. Its eastern boundary is on the westerly slopes of Santa Monica Canyon, perhaps 40 or 50 feet above the bed of the canyon; its western boundary is in the small gulch between the wharf and engine stall. It contains, more or less, 250 acres. To the best of my knowledge it is either the property of Mr. C. P. Huntington or it is the property of some person closely connected with him, but it may be said (and I would say accurately if I knew it) that undoubtedly Mr. Huntington controls that property. To make it clear, it is the property abutting on the ocean between near the western boundary of Santa Monica Canyon, where we have a trestle crossing the canyon, and the engine stall. This description is sufficiently general. If any further details are required it is a matter of record and maps will be furnished. I say this so there will not be any misunderstanding. I do not wish in any way to conceal the fact that Mr. Huntington owns an area of land running back probably three-fourths of a mile, as I have described. I wish to emphasize it, because in all these matters my understanding of the appearance before your honorable Board is that we shall endeavor to facilitate your labors by giving you any facts that we have in our possession, and if anything is omitted by myself that anyone thinks I should present, I shall be thankful if they will call my attention to it and I will tell them all I know.

In reference to the opportunity for more tracks on the beach at Santa Monica, the chairman and members of the Board have seen that ground and I will say nothing. That is all I desire.

There has been a question raised about the Santa Monica Tunnel. This Santa Monica Tunnel, as you all know, is the tunnel referred to in the act authorizing the construction of a harbor and authorizing the existence of this Board. The Santa Monica Tunnel is 331 feet long from face to face of portals. It cost complete, as it now stands, exclusive of track and ballast, \$6,879.92, and also exclusive of freight on the timber used in its construction, to be exceedingly accurate. You will notice \$6,879.92 is \$20.78 a foot run, also exclusive of freight on timber. For details please see Exhibit No. 2, in which you will find a most minute account of the cost of this tunnel.

In building this tunnel it was necessary to remodel a portion of the bridge there by which Ocean avenue crosses our track and the arroyo at that point. It is properly a part of the cost. To remodel the bridge cost \$498.58. Just west of the tunnel a short distance, as you gentlemen remember and everyone here knows, there is a very fine bath house owned by Senator Jones, I believe, and this bath house has between it and the Southern Pacific Railroad, I think, a county road. At any rate, there is a road or highway between the bath house and our track. The question has been raised whether this would not make it difficult for other railroads to come in even if they built parallel or other tunnels. Of course this is a trifling question. I hardly need to elaborate upon it, but it is quite obvious that this is a matter of detail, that it is a small expenditure of money. It is quite obvious, for instance, that if in any case it was expedient to build a tunnel 1,000 feet long, for instance, it could be built as cheaply as we built ours. These matters are ridiculous; they are trifling in railroad construction. Further than that, it is quite obvious that in such a case, with more tracks to the northward, we could take the northerly track opposite the tunnel coming into our present track some distance beyond the bath house, and the road that took the track through our present tunnel could take our track at the bath house. There would be no trouble then, and all these matters are implied in the act, as we are practically bound to furnish every facility from the easterly end of the Santa Monica Tunnel westerly to the wharf, including it. In fact, as you gentlemen know, we are put something in the position of nature as illustrated by the ocean for steamships. You notice a man that starts a steamship line has the highway provided for him. He does not have to build or repair it. We provide the highway and wharf and the other people join in making repairs. It is almost paternal.

It seems to me anyone who would advance an objection to the cost of the necessary work I have mentioned at this point near the tunnel certainly must have an idea that railroads ought to be found already built free of cost.

Some gentlemen have spoken to me on the question of whether the teredo and limnoria were not more active and more apt to attack timber piles in the natural state or in a protected state in calm water than in water where waves had more or less motion. I really know nothing about this. It may be that a part of the immunity that the Port Los Angeles Wharf has heretofore enjoyed from the attacks of the teredo and limnoria may be due to this. I really do not know, but it has no bearing on this question. A protected harbor must have stable supports for its wharves. Whether those supports are creosoted timber, iron, or any other form has nothing to do with it. If this objection should be raised to wharves in a protected harbor, I can not see what bearing it would have excepting that no harbor should be protected, which is a very extraordinary proposition.

In reference to the confidence that shipowners at present have in Port Los Angeles as a reasonably safe port I will say that insurance to-day (and I will take the worst

time, and that is in the winter months) is a common rate to all ports south of San Francisco. The rate averages 2½ per cent, and that is an average of one-half of 1 per cent higher than the insurance rate on ships sailing to the port of San Francisco. I have filed an appendix with full information on this point, and will say nothing further on it.

Mr. MORISON. Do you mean it is the same to Port Los Angeles as to San Diego?

Mr. HOOD. Yes, sir; every port south of San Francisco has a common rate at this moment. I have filed an appendix with a full account of that. The rate is one-half of 1 per cent higher than the rate to San Francisco. I refer to what we call the southern ports. I am in ignorance of the rates to points north of San Francisco. I have taken no interest in it whatever.

It may be expected by the Board that we will offer certain petitions. We will not. You will find a sample of filing petitions in Executive Document No. 41, Fifty-second Congress, second session. We offered some there. We will not do it here. You are well aware how petitions and signatures thereto are secured. Sometimes where there are opposing interests the same man signs both petitions. I do not suppose that you wish anything of this kind. It is something like signing letters of personal recommendation for employment, and you all know how that is; but I will say, as showing what the merchants of Los Angeles think, the shippers, the only ones who know anything about these things (that is their business; others may know it as a matter of interest), are very apt to indicate their opinions by the way they consign their freight.

I will file with you a series of exhibits of the most elaborate character, one exhibit showing the name, the registered tonnage, the date of arrival, and the amount of cargo of every vessel, inclusive of the Pacific Coast Steamship Company's steamers, which has arrived at Port Los Angeles from the time it was first constructed until December 10 of this year. This is all the petition I want. I will also file elaborate traffic statistics in connection with both Port Los Angeles and San Pedro inner harbor. These statistics will show completely the traffic handled at all points, its character, and the ships. It will show the traffic handled by the Pacific Coast Steamship Company at all points, including Redondo, and absolutely what it was. It will show how it was handled by the sundry railroads at those points. I file this because it may save you gentlemen some labor. It is open to the inspection of everyone so far as I am concerned, and I trust you will find it interesting. These statistics, as showing the real opinion of shippers in regard to Port Los Angeles, are eloquent, and I will not take up your time with any further account of them whatsoever. There is one thing to be remembered in this matter that seems not to be fully appreciated by all parties, but undoubtedly you gentlemen of the Board appreciate it. Whatever may be thought best to do with the inner or outer harbor at San Pedro, Port Los Angeles has come to stay. That is so obvious I need to say nothing on that subject.

I will, with your permission, also file with you an exhibit showing distances by rail on the lines of the Southern Pacific from San Pedro; from where would be the end of the wharf if we had built it in San Pedro outer harbor; from Port Los Angeles, from Santa Monica, from Declez Quarry, from Chatsworth Park, and from sundry other points to Los Angeles. I think this table of distances is exact and can be verified, and I file it simply to save the members of the Board the trouble of looking them up, although I should, of course, expect them to be verified.

In conclusion, I would like to say (and this will be my conclusion, except a few remarks that I trust I will be permitted to make in presenting the successive advocates of Santa Monica) that the study of the properties, the difficulties of approach, the facilities of approach, if you choose to put it that way, at the two places, together with the terms of the act under which your honorable Board was appointed, makes it plain to my mind, and I think, to anyone's mind living in Los Angeles, that the only harbor under consideration where the Southern Pacific Railroad is not in a position to make it exceedingly disagreeable for any other corporation to come in, is the harbor at Port Los Angeles.

Mr. MORISON. There are two or three questions I would like to ask before you sit down. I observe that your wharf has rather a peculiar alignment. What is the reason of that?

Mr. HOOD. We were making borings, and of course we did not know whether there would ever be a breakwater there, and we were going to build a wharf at Santa Monica anyway. It is quite obvious (I need not mention it except for the information of those in the audience who may not be technical) that until a breakwater was there, it was necessary that ships at the berthing end of the wharf should lie easy with the swell. It is therefore vital that the wharf should be pointed toward the prevailing swell. To make this clear, the westerly swell when it comes around Point Dume acts in a peculiar manner. It will frequently commence in the morning with a pretty light swell coming off in this direction [showing], to illustrate without intending to be exact; as the day progresses and our regular westerly

winds progress in strength (there is no force to them) the swell gradually veers around more from the south, and as the result of long continued, careful, and expensive observation, my conclusion was that the swells came in in the direction of north $42^{\circ} 24'$ east, magnetic, or south $42^{\circ} 24'$ west, magnetic, which is the same thing. I concluded that that was the direction of the heaviest summer swell without storms as near as I could get at it. I obtained that information in a curious manner. I had a large scow with a donkey engine on it, and by changing its position I finally got that direction. In other words, I used the scow as if a wharf. I think the gentlemen who have operated the wharf will say that it was a pretty good direction. Further than that, it is quite obvious that in building the trestle approach to the wharf our point was to make a short means of reaching the 5-fathom line. We curved around normally to the 5-fathom line. A little before reaching the 5-fathom line we put in a slight curve. There are 22 or 23 degrees of total curvature. Then we curved into that direction [showing]. Now we considered going straight in that direction from the shore [showing on map]. I did not wish to do that because it drew us too far this way [showing on map]. It did not give us as free an amount of deep water to the westward, and I did it for that reason.

The question might arise (and I am trying to cover all the points) why we did not produce that line of shore here [showing on map], leaving the main wharf where it is now. The main reason was this: We knew we needed a good deal of track room. It was necessary to have track room for the convenience of handling traffic as close to the wharf as we could get it. I wanted two side tracks and wanted them about 2,000 feet long. The consequence was that after leaving Santa Monica Canyon, where we had to have a bridge of some character, we carried the railroad up essentially 2,000 feet before turning normally to the fathom lines, and then put it in that position which combines all the requirements. If we had carried it in its present direction shoreward, we would not have secured over 800 feet length of side track, and now we have 2,000.

Mr. MORISON. Have you ever contemplated filling the approach?

Mr. HOOD. We have considered it. Perhaps you would like to know why we filled the part we did. That is really a matter of some interest. We intended to fill it, but we had not decided when we commenced the wharf just how much we would fill. I suspected something and commenced observing. We carried out this 320 feet of temporary trestle and I commenced observing it. Just what I expected occurred. There was a good deal of coarse sand and some pebbles swashing with the waves, and it commenced to cut the piles out by wear, and in order to preserve the temporary trestle so we could operate it until we were ready to fill it in, I had to take Oregon pine 3-inch plank and spike around the bottom of it down to the bed of the sea, as a protection, to prevent their being cut off. Then I knew what I had to do, and I carried that temporary work out to a point where I found there was no such action, and at that point we commenced creosoted pile construction and made the rock fill.

In further answer to your question, it is our intention if a breakwater is built here, but not otherwise, and if the Government will consent, to fill out all along on the inner harbor wherever we have control (and we have control, as I have already mentioned, from Santa Monica Canyon to the wharf); then Senator Jones owns for some distance, and I have no doubt he will give his consent. We have intended to take material from the hills, if the breakwater is built, and fill out to a suitable depth, giving area for mills, lumber yards, and any other purpose—you know how cheaply it can be done with the material at hand, and how slight a protection will be required if the breakwater is there—then from that, put out small slips for the use of lumber vessels.

Mr. MORISON. What governed the position of the end of your pier?

Mr. HOOD. How long it should be after we got beyond the 5-fathom line?

Mr. MORISON. Yes.

Mr. HOOD. There was nothing governing it except we figured that we would want the westerly side of the wharf, where the coal bunkers are of a certain length. We wanted a certain capacity. We figured the length of the coal bunkers so that we would have sufficient room for two colliers at a time if necessary, and then we desired that shoreward there should be room for one ship, and of course that would give us the length on the other side—bunkers on one side and one ship on the west.

Mr. MORISON. There is no reason why that pier should not be shortened or lengthened if necessary at any time?

Mr. HOOD. No, sir. We came very near carrying it out 300 feet farther, and then we decided we could do it when we needed the room. We discussed among ourselves this proposition, and we waited to see whether in case we needed more room it would not be better to carry another pier from where that curve is at a suitable berthing distance parallel to the direction of wharves that would be put up after the breakwater was constructed. It was obvious we could not do that until the breakwater was constructed, and up to the present time we have got along well enough,

and my opinion is, for anything like bunkers, we are in deep enough water now. If you will allow me to think a minute, I believe the depth at the outer end of the bunkers is approximately at low tide 33 feet; 7 feet the water rises at high tide. That would make 40 feet. It is 16 feet to the top of wharf, which would make 56 feet, and the center of gravity of the coal is pretty close to 35 feet; we will say 34 above that—that is, the center of gravity in our bunkers is 90 feet above the bed of the ocean, and that is as high as we want it.

Mr. MORGAN. You had a preliminary experience with a scow?

Mr. HOOD. Yes, sir.

Mr. MORGAN. Now, you have had four years of a more practical experience in relation to the location you adopted. Would you now modify the direction of that pier if you were to reconstruct it?

Mr. HOOD. No, sir; I would not. I will say in explanation of that, that the lighter swells usually in the summer months come in in this direction [showing on map], and are unimportant. They do not moor a vessel. It looks like a duck pond. It is mere undulation, and the heavy swells of summer are in that direction [showing], and that is the direction of the wharf. The storm swells that Mr. Corthell mentioned at Port Los Angeles (it is almost absurd to talk of them as heavy waves) come in from south 30° west, or that direction [showing], or north 30° east, always magnetic, and they are of such rare occurrence that we had rather be inconvenienced two days in the year than three hundred and sixty-three. We have built our wharf here not in reference to the storms. We have built it in reference to the greatest number of days in the year in which we wanted to do business.

Now, in connection with that, if I am not occupying too much time, I will say something which is in the line of Colonel Morgan's question. There was almost a phenomenon there. We built better than we knew. There are 5,084 piles in that wharf, if I remember rightly, and as I have heard that you gentlemen steamed around the wharf, you can imagine that it is a forest of piles. Their distance apart is not great, and they have acted in a very peculiar manner that we never expected. For instance, with the waves coming in from the south 30° west, as I have mentioned, in a pretty fair storm, there was an instance where the steamship *Corona* (a vessel of the Pacific Coast Steamship Company, a little smaller than the *Santa Rosa*) came to Port Los Angeles with some doubt as to whether to go in or not. I suppose the waves might have been 6 or 8 feet high. I do not believe they were higher than that, but they were storm waves. They came in from this direction, slightly quartering on the wharf, and it would seem as though the waves that did not strike the wharf ran faster than the ones that did, owing to the obstruction of the wharf. That seemed to have raised the surface of the water and produced an outflow in the line of least resistance, which obviously is at right angles; and on the easterly side of the wharf, with a southern gale blowing and the waves coming in, as they always do, from the southwest, the steamer ran in, and instead of having to be breasted off to the buoys, she pulled on her breast lines. It was a remarkable thing, and I was never more surprised in my life.

Professor BURR. Have you made any observations as to any possible current parallel to the shore between your pier head and the shore line?

Mr. HOOD. Yes, sir. Before we built the wharf, while we were making our preliminary examinations, I had some floats put in in this way: I took some railroad ties and weighted one end of each tie to such an extent that it would come just above the water line, and stuck a little flag on it. I had a long string of them connected with a life line and anchored at one end. We had men stationed on top of this bluff, and their instructions were to get in line with those flags and follow them around and take observations of them, triangulating to them. Sometimes certain conditions of the wind and tide would make them go one way, sometimes another. Very commonly they were in a different line. It seemed to me they did not go deep enough to be an indication of the real current, as unaffected by the movement of the top surface of the water as affected by the wind and waves. You will notice the rock fill being at an angle to the waves; they race along it and catch the sand on that side and carry it out into the water. It is deposited on the westerly side. If there were a southerly and easterly current, the sand which is cut up by these racing waves would not be deposited on the west side of the wharf; it would be deposited somewhere else. That is all I know about that matter.

Professor BURR. Then, so far as your observations have gone, you have not been able to detect any uniform shore current?

Mr. HOOD. No, sir; we have noticed what I had in my own mind considered evidence of the preponderance of westerly movement, not a uniformity.

Professor BURR. You say you have not been able to observe any material amount of sand deposit on either side of the fill?

Mr. HOOD. We have observed a marked deposit on the westerly side up the coast. It has changed very much since we built that fill, very much, and it has scoured at the foot of the fill, scoured materially.

Professor BURR. That is right in front!

Mr. HOOD. Right in front, at the toe of the fill. The profile will give it more plainly. There is a marked deposit on the westerly side of the fill—that is, up the coast.

Professor BURR. Can you tell me about what is the maximum height of the rollers which you have experienced there? I mean from crest to trough. I mean at the end of the wharf.

Mr. HOOD. I have never seen a wave at the end of the wharf that I thought was 4 feet high from trough to crest, and I have tried to make myself believe it was as high as that. I wanted to see some waves. We will present some one who has lived there all the time and take his opinion. Personally, I have never seen a wave I really believed was quite 4 feet, but I have not lived on the wharf. I have been there very often.

Professor BURR. Mr. Hood, you have proposed the location of a breakwater in front of the end of the wharf. What is the proposed distance of that breakwater as you have located it from the end of the wharf?

Mr. HOOD. You have the distance on the chart, so I won't say what it is. My remembrance is that it is something over half a mile, or thereabouts. That is subject to correction by the charts. That distance seemed to us sufficient. Further than that, of course our point was to get the breakwater in as shoal water as would give sufficient distance. That is all there was to it, and we thought that half a mile was enough. That is also simply an opinion, and it happened also we were using practically the same length and practically the same distance from the 5-fathom line that the breakwater plan south of Santa Monica, as drawn by the United States army engineers, used. From here [showing], about the 5-fathom line, there is very much less depth of water, which I think I brought out yesterday. In further illustration of that point, it may be asked why this was turned so [showing]. That is really evident because the fathom lines go off something in this direction [showing], and with the direction shown of the westerly arm of the breakwater.

Still another point. It might be asked why we extended the breakwater farther behind this point here than we did beyond this illustrated proposed wharf. It is simply this: The most important swell to guard against is not the storm swell. It is the swell that prevails most of the time, and if not protected against would undulate ships at the wharf. I think it is fair to say that very much more than three hundred and fifty days in the year that is the maximum swell. I don't think it averages ten days in the year by any possibility. It certainly has not since we built the wharf. That swell is not a storm swell and not in the storm swell direction. This easterly proposed wharf is, in fact, better protected from this general swell than the Port Los Angeles Wharf is. It is pretty well protected from storm swells, but not so well as Port Los Angeles, but it was necessary to extend this breakwater as far as we have to protect Port Los Angeles Wharf from ordinary heavy swells. You would see that in a moment if the lines were on there.

Professor BURR. Suppose the filling which you have contemplated—that is, from the shore end of the wharf—had been made, have you, from your experience in that location, any opinion as to the scouring or possible scouring effect of any shore current between the breakwater which has been contemplated and that pier?

Mr. HOOD. Yes, sir. That, of course, we considered at the time. We considered that in making this pier. The shore currents, as I have stated, are sometimes one way and sometimes the other. They are exceedingly moderate. I have always considered them moderate in this part of Santa Monica Bay, on account of the depth of the indentation of the bay.

You notice that it apparently is so, because the fathom lines are such an unusual distance apart on that submerged plateau. My idea is—which I present with a great deal of diffidence—that the shore current in that situation would be very wide and to that extent less perceptible, and it would have no effect, except possibly requiring the piles to be driven a little deeper; in fact, bulkheads would possibly require blanketing out and the rock protection that I have mentioned before added to prevent the bottom scour tripping the rock; but really I do not believe the current is strong enough in Santa Monica Bay to be very noticeable, but it is always reasonable to me that it was probably very wide, from the shape of the bay.

Mr. RODGERS. I understood you to say you had noticed considerable deepening inside of the wharf?

Mr. HOOD. Yes, sir.

Mr. RODGERS. Is that of such a character as would injure the wharf?

Mr. HOOD. Oh, no. You will simply see all that by the profile which I will file with you. I will show you one now. You will see by the profile that in that part of the wharf there was a foot and a half of clay and sometimes a little gravel, sometimes mud overlying this clay. Now there has been a scouring that has cut down to the clay. It is a tough clay, and it would take a violent scour to cut into that clay. To illustrate, in crescenting piles they are not as strong and don't stand driving as well as in a natural state. They are of Oregon pine. You can drive hard

creosoted Oregon pine considerably without injury, but if you drive it too hard it will break. In some instances, when the piles were as little as 6 feet into the bed of the ocean, we could tell by the feel of the blow that something was wrong, and it had to come out. We didn't think it safe to trust that piling. We tried to pull them, but we never did pull one which was in as much as 6 feet. We would break the lines. So we would simply break the pile off on the side showing the least resistance and drive another. It was the toughest clay I ever saw. It was perfectly hopeless to attempt to pull anything out of it. You can imagine how slowly that will scour.

Mr. MORISON. There was a previous wharf in use at Santa Monica?

Mr. HOOD. Yes, sir.

Mr. MORISON. When was that built, and where was it?

Mr. HOOD. It is not down upon the diagram, but it was built, if you would allow me to use my pencil, right here [showing], in an extension of the track east of the east end of the present tunnel. It went out, I should think, 1,500 feet, or maybe 1,800 feet, more or less, and it was used for some time. I was on it while I was in service. I remember going on the wharf after it had been in use two or three years, perhaps. I remember being on the wharf in 1876. The reason I was there was that the Southern Pacific Railroad Company had just acquired the road and the wharf, and I went down to the wharf to look at it. I had never seen it before. They used to have a good deal of trouble there. They used to have very heavy lines in stock to help out ships that were not sufficiently well equipped in lines, for there is a much heavier swell down there than we have at Port Los Angeles, and that is one of the reasons why they went to Port Los Angeles. It was not a very good place for a wharf. It was about such a place as any of these wharves have, as at Redondo, and of course you gentlemen all know they lost a part of their wharf there the other day. The swell was so heavy that it tore the piles out.

Mr. MORGAN. The wharf was built something like twenty years ago?

Mr. HOOD. Yes, sir; I was on the wharf twenty years ago, in the summer, I think about July, and it was built a year or two before that.

Mr. MORISON. When was this wharf abandoned?

Mr. HOOD. Well, I am not clear as to that time. It was abandoned some time, if I remember rightly (though possibly I may be wrong)—I think it was abandoned between 1878 and 1882. It may have been abandoned earlier than 1878. There was a time there that for four years I was continuously between Yuma, Ariz., and San Antonio, Tex. I didn't keep very close track of those things. I had other duties. I couldn't tell you exactly. It was somewhere along about that time.

Mr. MORISON. It was abandoned not later than in 1882?

Mr. HOOD. Not later than 1882, I think, but I am subject to correction on all of that. It was not a good wharf. It was not treated piles, you know, and it got rotten and weak, and it was not a good thing to maintain; it was not fit to maintain. The question was, as I remember having been informed about it, whether to rebuild it or abandon it, and it was abandoned.

Mr. MORISON. You stated yesterday that you would file exact dates in reference to the San Pedro Wharf. Will you be kind enough at the same time to file the dates at which the work was begun on the Port Los Angeles Wharf and when completed?

Mr. HOOD. Yes, sir.

Mr. MORISON. The dates at which the work was abandoned or discontinued on the San Pedro Wharf, and when it was begun and finished on the Port Los Angeles; the date at which the old Santa Monica Wharf was abandoned.

Mr. HOOD. Say "Date of taking down the old Santa Monica Wharf." I will have that looked up in the office and furnish it to you, near as I can get it.

The CHAIRMAN. In placing your breakwater there according to that plan, at what depth of water did you place it?

Mr. HOOD. It is essentially 7 fathoms. Of course, that was the United States Army map. These are both copies of the charts [showing diagrams].

Mr. RODGERS. In regard to the action of the current there, you have said that the clay was so hard as to prevent any possible erosion.

Mr. HOOD. Such erosion is not probable; it is in any event very slow.

Mr. RODGERS. The question I want to ask is, whether the clay is so hard as to prevent an anchor from entering?

Mr. HOOD. Oh, no; it is down. It is almost always covered either by mud or by a layer of sand or mud, or something of the kind. Perhaps I had better show the profile and you will see at once [showing and explaining profile]. The bed of the ocean is represented by these black crosses. The date of this was May 8, 1896. Now, gentlemen, if you will allow me a moment, I will give you from the map a matter of importance.

This large map was made for illustrative purposes, as is evident by the thickness of the lines. Of course, on this scale it is well and good. This is the Southern Pacific Railroad, as you all know. This is the Southern California Railroad, or the Santa Fe System, and the present end of the Southern California Railroad is shown

approximately correct here, but the road does not connect with our track there. It ends a few hundred feet from our track, which few hundred feet is easily constructed. The railroad connecting the two does not exist. That was used in a discussion of the matter as an illustration of a possible way of connecting them directly with the tunnel by passing under our race track here, instead of what we call "sawing" our trains. There is no physical connection of rails at present between the Southern Pacific Railroad track and the Southern California Railroad at Santa Monica, but it is easy to make one. That correction should certainly be clearly understood, for it is easy to understand on the ground.

Now, Mr. Chairman and gentlemen of the Board, the next presentation in favor of Santa Monica Harbor site will be made by Mr. J. A. Muir and two assistants. Perhaps as the presentation proceeds you may be disposed to kindly allow an irregularity to this extent—would it be permissible for Mr. Muir to ask questions of his assistants for your information, directly and verbally?

The CHAIRMAN. There is no objection to that.

Mr. MUIR. Mr. Chairman and gentlemen of the Board, I have not a great deal to say on this subject. I have been in charge of the maintenance and operation of the wharf since its completion, when it was turned over to us by Mr. Hood. During that time we have had some storms. Storms will come, and with one exception there has not been any difficulty in handling the traffic that has come to us. That one exception was on the 2d of March, 1896, when the ship *Dunboyne* was at the wharf, and the storm came up suddenly. The steamer *Collis* attempted to take the *Bunboyne* from the wharf, and was not able to at all, and could not until after the storm was over, and then we discovered that she had lost a blade of her propeller. We have had five copies of the accident report of the ship *Dunboyne* made and will file them with you.

Mr. MORISON. Where did the ship lie?

Mr. MUIR. Just where the *Port Crawford* was lying the other day when you were at the wharf.

Mr. MORISON. On the east side of the wharf?

Mr. MUIR. On the east side of the wharf.

Mr. MORISON. As far inshore as you have deep water?

Mr. MUIR. Yes, sir. That is where the *Port Crawford* was lying. That was her discharging platform, or one of them. We had another storm on the 25th of November last, which was enlarged upon in the newspapers to a considerable extent, in view of the fact, I suppose, that the Board was going to meet here. I have a newspaper clipping here, from the Times, in which they describe the great difficulty that the *Santa Rosa* had in lying at the wharf on that morning. It claims that Captain Alexander remained on the bridge all the time the ship was there, fearful of danger.

It happened that Mr. Riley, the photographer, of Santa Monica, took a photograph of the wharf and the steamer lying there during that storm. She had passed Redondo that morning, the storm having carried away 150 feet of their wharf, and had come to our wharf and landed without any trouble whatever. Mr. Riley has made an affidavit as to that photograph, and also an affidavit by Captain Dornfeld, who was in charge of the wharf on that morning, also a letter attached to it from Captain Pillsbury of the *Mincola*, a collier that came in at 11 o'clock, right in the height of that storm, in which he describes his trip down the channel, and describes how heavy the weather was just outside of Point Dume, and states that he went to work discharging coal immediately on his arrival at Port Los Angeles. I will also file that with the Board. There are no other accidents or any information that I can give you besides this; that the wharf has been entirely a success, so far as maintaining and operating it is concerned, since its completion.

I would like now to present the man in charge of the wharf, Mr. Jamison, who will state further to you any little minor details that I may have overlooked, not being there myself.

Mr. MORISON. Be kind enough to allow us to look at that photograph.

Mr. BURR. What was the direction of that storm?

Mr. MUIR. I will have to call on Mr. Jamison for that. I think it is given in Captain Dornfeld's affidavit.

Mr. BURR. Did she touch at Redondo?

Mr. MUIR. She did not touch at Redondo, because the storm was so bad, and she came to Port Los Angeles and laid there. The storm carried away a portion of the Redondo Wharf. She was coming up the coast. Mr. Riley states at what hour she arrived.

Mr. MORGAN. About what distance was he from the point of observation?

Mr. MUIR. Well, probably about 2 miles.

Mr. HOOD. Mr. Chairman and members of the Board, allow me to present Mr. Jamison.

Mr. JAMISON. Gentlemen, I would say in regard to landing and discharging cargoes at the wharf, that I have been on that wharf and in charge of it since May,

1893, and during that time I will say that, from observations made, there is not ten or twelve days during the year that any class of ship can not land and discharge at the wharf. We had the accident with the *Dunboyne*. That is the worst accident we have had. There has never yet been a time when the Pacific Coast steamships could not land at the wharf and discharge their freight.

Mr. BURR. Was the *Dunboyne* injured?

Mr. JAMISON. She was. Her overhead was lifted and starboard bulwark bent to the sheer stroke; main pin rail was split and had to be removed to the scarf, and at the forecable head between there and the foremast.

Mr. BURR. What was the direction of this storm?

Mr. JAMISON. To the *Dunboyne*? It started in from the southeast and blew several days from the southeast, and then came around to the westward, and finally ended up in the northwest.

Mr. BURR. That was a southeast storm?

Mr. JAMISON. That is the usual southeast gale; yes, sir.

Mr. BURR. Have you any idea of the height of the waves cast up by that storm?

Mr. JAMISON. They were the heaviest I have ever seen them. I have no way of measuring those waves accurately, but, in my judgment, I should say I never saw a wave there more than 5 feet in height, from trough to crest. Between 4 and 5 feet.

Mr. BURR. That is, you would not estimate them during that storm as more than that?

Mr. JAMISON. Not more than that; no, sir.

Mr. BURR. You stated, Mr. Jamison, that there might be ten days in the year when there would be difficulty in using this pier, at the present time?

Mr. JAMISON. That is, for all classes of ships?

Mr. BURR. What would be the nature of the difficulty during those ten days? Do you mean ten days in storms?

Mr. JAMISON. There would be ten days that there might be a heavy swell. When you were down the other day, the ships were not working on account of the swell. Now, take it in this case, and they work there quite well, but those deep-water ships and tramp steamers are adapted to very light waves in port, so that they will not stand very much sea at a wharf. They are adapted to running into ports like San Francisco and New York—inside ports.

Mr. BURR. Do I understand you to mean that these coast-line steamships, for instance, would have no difficulty?

Mr. JAMISON. They would find no difficulty at all; no, sir. There was a steamer landed there the night that you were there, and left there that morning at 6 o'clock.

Mr. MORISON. Supposing a ship arrives during one of those ten days. What do you do with her?

Mr. JAMISON. She would lie at anchor.

Mr. MORISON. At anchor out in the bay?

Mr. JAMISON. Yes, sir.

Mr. MORISON. You would not bring her up and moor her off the wharf?

Mr. JAMISON. No, sir; it is unnecessary, and saves dockage by having her at anchor.

The CHAIRMAN. If you had wanted to get the cargo out of the *Port Crawford* the other day, when we were down there, would you have had any particular difficulty in getting it out?

Mr. JAMISON. No, sir.

The CHAIRMAN. You would not have been in any hurry about it?

Mr. JAMISON. There was no hurry about it at all. If we had been in a hurry, and if she had been hauled in, she might possibly have started a chock or bit, or something like that. We didn't want to take any chances on it. Those ships are lightly fitted up, and if those people had been in a hurry for the cement, we could probably have worked it, but it was thought advisable not to.

Mr. BURR. Does any ship at anchor ever drag its anchor at that point?

Mr. JAMISON. No, sir. All the seamen that have been here—captains—I have always heard them state that the anchorage was remarkably good, and the holding ground was good.

Mr. BURR. You have never known of a vessel dragging her anchor since you have been there?

Mr. JAMISON. No, sir. After the *Dunboyne* was taken from the wharf where she was, and a German ship came in that afternoon, the next morning they both laid at anchor comfortably.

Mr. MORISON. Did you go on the wharf when it was opened for traffic?

Mr. JAMISON. Yes, sir.

The CHAIRMAN. Then you have been there during the entire life of the wharf?

Mr. JAMISON. Yes, sir.

The CHAIRMAN. Were the bits torn out of a steamer eighteen months or two years ago at the wharf?

Mr. JAMISON. I don't remember any instance where a bit was torn out of a ship. I remember one instance at the present time, where the bit was cracked across. That was on the steamer *Peter Jackson*. If you will allow me I will explain to you how the strain came on the bit, showing how it was cracked. The bit was right at the brake of the poop on the main deck. The ship was lying this way.

The CHAIRMAN. Was she a coast steamer or a tramp?

Mr. JAMISON. She was a tramp steamer, coasting. The bit was across the ship that way [showing]. It was fastened onto the deck, just to the deck plates. There was no extra strengthening there to the bit at all. The breast line lay under the wharf and came through, and the steamer made fast by this bit crosswise, and when the strain came on it, I think that it gave a little from the place and allowed the bit to crack right across the base there. It was not torn out.

Mr. MORISON. It was one of those doubleheaded bits that came through the deck?

Mr. JAMISON. Yes, sir; it was not torn out, it was cracked.

Mr. MORISON. An iron bit?

Mr. JAMISON. An iron bit, yes, sir; going through the deck plates. A cast-iron bit. That is all I remember at the present time.

Mr. HOOD. Perhaps Mr. Jamison's memory could be refreshed by the name of any vessel referred to. I know there are many trifles which could be mentioned, which would be very difficult to furnish any exact information upon.

Mr. GIBBON. The vessel, as I understand it, was one of the Pacific Coast Steamship Company's. I am under the impression it was.

The CHAIRMAN. Did any such an accident happen to a Pacific Coast steamer?

Mr. JAMISON. I don't recollect of that at present. I don't say that it has not occurred. There was no tearing out. There was never a bit torn out; but I might look that up, and let you know later on about that.

Mr. HOOD. Mr. Chairman, perhaps some reference is made to the *Corona*, Captain Hall. Perhaps Mr. Jamison was not there; I don't know. I should think there could be no objection on the part of these gentlemen who are originating these questions, to say what they mean, and then we will answer.

The CHAIRMAN. Address your remarks to the Board.

Mr. GIBBON. I believe it was the *Corona*; I know it was a vessel. I don't remember the name of it but it was a Pacific Coast steamship. I am pretty sure that is the right name.

Mr. HOOD. Mr. Chairman, I would like to say that I know of some trouble with the *Corona*, Captain Hall. That wharf was turned over by me to Mr. Muir to operate after that. I was operating it myself, with my assistants, and I can tell you all about it. I think Mr. Jamison was there at the same time, handling freight for us.

The CHAIRMAN. Do you know of such an accident to the *Corona*?

Mr. JAMISON. No, sir; I do not. When the *Corona* landed at the wharf, the first time she landed at the wharf, she got her breast lines, instead of running under the wharf and giving them plenty of scope, made them fast to the piles next to the steamer, so that virtually the steamer was hung up on those belay piles, and when a little swell came in, 2 or 3 feet, she would settle down and the lines were as tight as they could be to hold her close to the wharf, and she carried away those lines; but I have no knowledge of her carrying away any of her deck gear at all. The lines did carry away.

Mr. BURR. You attribute that to their being improperly secured?

Mr. JAMISON. Improperly secured. They, of course, could not hold up the weight of the ship.

Mr. BURR. That would be a proper way of mooring a ship in a protected harbor?

Mr. JAMISON. Yes, sir. In a protected harbor the line would not stretch very much.

Mr. HOOD. Mr. Chairman, before introducing the next witness, if you wish, I will tell you about the *Corona* at that time, as I handled it entirely. The fact is that at that time Mr. Jamison was on the wharf, as he states, and I think Captain Dornfeld was on the wharf, but that is immaterial. The wharf was in charge of my assistants, because it was not completed, and I had provided, after a great deal of study, the breast lines which I suppose you may have noticed down there, which would bring the scope across the width of the wharf over 130 feet, and naturally with a falling or rising tide the breast lines produce a strain on the ship and on the wharf and they pull on the whole wharf. Captain Hall, of the *Corona*, insisted on tying up with short breast lines over the mooring piles at the side of the wharf at which he lay, and he did it once or twice. In this instance there was quite a little sea running, and I guess there must have been 3 feet of waves in height and a falling tide. My assistant was weak-kneed, and did not order him away from the wharf. I came very near ordering the assistant away for it. In doing it on a falling tide when the ship hung to the wharf it looked as though it was intended, and looked as though they were trying to pull out the piles. They didn't pull them out, but they did break the line that the steamer had used for that purpose, and did more or less injury. I went to Goodall, Perkins & Co.'s office, to whom I will refer you for the accuracy

of this statement, and I told them they could either have Captain Hall tie up his ship under my direction or they could take him and his ship away. He tied up under my direction thereafter.

Mr. BURR. Was there any damage done there to the wharf at that time?

Mr. HOOD. No, sir; none whatever.

Mr. Chairman and members of the Board, I will next present Captain Dornfeld, who is wharf master at Port Los Angeles. He does not come here to make a statement. He will answer any questions you may ask him, and if you have no questions to ask he will have nothing to say.

Mr. MORGAN. Captain Dornfeld, how long have you resided on this coast?

Mr. DORNFELD. I have been on the coast for probably about thirty years, off and on.

Mr. MORGAN. Master of a vessel any portion of that time?

Mr. DORNFELD. Yes, sir; some eight years.

Mr. MORGAN. In this locality?

Mr. DORNFELD. Yes, sir; Santa Monica, San Pedro, and Catalina and up and down the coast.

Mr. MORGAN. I wish you would describe pretty fully a southeast storm. There has been a great deal said about southeast storms. I would like to have you describe one somewhat in detail from the commencement of it, as it appears here, to the termination of it, what is known as a characteristic southeast storm.

Mr. DORNFELD. Well, at times we have a storm come on without any warning. At other times the atmosphere will be rather murky, hot, and sultry for a day or two. Then the wind will probably start up from the eastward with a trifle of rain. At times again some southeasters would start in with no rain. Then it will rain a little—probably such a thing as twelve hours. The wind would increase and blow quite violently from the southeast. It would blow probably for twelve hours from the southeast, gradually shifting around to the south, and we have always figured on the southern portion of the coast that, when the wind begins to shift around from the southeast to the south, as we term it "its back is broke." From the south it shifts around to the southwest, indicating a rising barometer and fair weather, going around to the west and northwest. That is about the usual run of southeast storms we have here. That is my experience down here for the last thirteen years.

Mr. MORGAN. In speaking of the southeast you mean magnetic southeast?

Mr. DORNFELD. Magnetic southeast; yes, sir.

Mr. MORGAN. And you move around 45 degrees. What time is occupied in the changes that you speak of from southeast to south and south to southeast, the time that is occupied in those changes as near as may be here?

Mr. DORNFELD. I could hardly fix it for the simple reason that it is in this way: A southeaster will blow for twelve hours at a stretch from the southeast, and I have known some to blow for a couple of days, but when they once begin to move, that is, when they once begin to shift from the southeast to the south, they don't take but a few hours. Well, there is such a thing as three or four hours from the south and southwest, but when they begin then we will have fine weather, the barometer rising and the wind shifting around to the west always. That is about the usual form of southeasters as we have them down here on this portion of the coast.

Mr. MORGAN. This is the proposition that I wanted to get at: The time that it occupied after the change commences—when the storm, the southeaster, changes its character somewhat and moves around till it strikes in a northwesterly direction, as I understand it?

Mr. DORNFELD. Yes, sir. That is the idea. That is the general law followed out by the storms in this part of the ocean.

Mr. MORGAN. Will you be kind enough to describe the action of the waves pending the storm in its inception and afterwards during the direction from the southeast and then during changes of direction?

Mr. DORNFELD. Well, I have seen southeasters at Santa Monica and I have seen southeasters at San Pedro, and probably the first six or eight hours there will hardly be any swell; but then after it has been blowing for a day and night, say for twelve hours, why there is considerable swell. The swell is short and very high. Then when the wind changes the swell is longer somewhat, and from the south-southwest to the southwest, and instead of being short and high-like they would come in with a long heave, a long swell as we call it, from the south-southwest or probably from the southwest. While the wind is from the southeast the sea is generally from the southeast until the swell is very nearly broke, when it begins to shift with the wind, only the sea has a different effect after it starts to heave from the southwest. That is, as I say, it comes in long and rolling, and is very dangerous. Where a ship could hold on probably in a southeast swell in a southern coast almost in any harbor near the coast where the ships run, from the south and southwest, generally with a swell at the back of it, it is a different proposition. It is hard on ground tackle, and I think that is the reason that most of our accidents have occurred on this southern section by the swells coming in from the south and south-southwest after a southeaster.

Mr. MORGAN. South-southwest you think are the heaviest?

Mr. DORNFELD. The south-southwest; yes, sir.

Mr. MORGAN. They are heavier than at any interval you have from the beginning of the storm until the position of south southwest is run?

Mr. DORNFELD. That has been my experience. And I think it probable that condition would be aggravated if there should be a westerly storm offshore for some days, and the westerly or southwest swell starting in and meeting this same gale that we often have had on this coast. The conditions would be different and the swell would be aggravated by some cyclonic interference offshore.

Mr. MORISON. Captain, how long have you been pilot of the Port Los Angeles Wharf?

Mr. DORNFELD. The last 23d of September, three years.

Mr. MORISON. Do all the vessels that moor at that wharf do it under your direction?

Mr. DORNFELD. Yes, sir.

Mr. MORISON. You have the right to order how they shall moor?

Mr. DORNFELD. Yes, sir.

Mr. MORISON. To order that they shall come there or not?

Mr. DORNFELD. Yes, sir.

The CHAIRMAN. Why did you order the *Enoch Talbot* last winter not to tie up at Port Los Angeles Wharf?

Mr. DORNFELD. Well, Mr. Chairman, we had the *Dunbogue* accident. Our agent at Port Los Angeles wired to headquarters at San Francisco in regard to the weather probabilities and to get the ship back. She lay out there twelve hours and had 500 tons of cement on, and we wanted to get it discharged from the ship as soon as possible, as she was chartered for a load of wheat. We thought it would be better to find out from the people up north and we telegraphed to headquarters and they telegraphed back that the indications were of a very severe storm. The German bark or German ship *Elizabeth*, of Philadelphia, came in that day. Rather early in the morning I saw two ships in the offing. They were probably 15 miles out, tacking and coming toward the port. There was quite a swell visible off in the channel, although it was not anything worth speaking of inside. Both stood in toward the port. I went out with a steamer and the German ship *Elizabeth* came in under short sails. I told them where to anchor and brought her to. Then I went out and I wanted to know what the other ship was that was there. They said that it was a coaster, an American vessel. I took the steamer and went out to see what it was and it was the *Enoch Talbot*, Captain Jackson, with a cargo of oil from San Pedro, and he had to take on 5 carloads, if I recollect rightly, which were at Port Los Angeles, for him to take on to finish his cargo. Well, I had known the *Enoch Talbot* for a good many years. I should say she must have been 33 or 34 years old, and my experience has been with old vessels that their ground tackle is not overly best. I should have done the same thing if it had been at San Pedro, probably. I should have advised her to stand to sea, as I already asked where he was going, and he said he was going in to the wharf. I said, "No, you can't get inside of the wharf now, captain, because the weather predictions from San Francisco, as telegraphed down, predict a heavy storm. I think you will do better offshore than you will in here," or something to that effect. I would have advised him the same in any case, as he could not get inside to the wharf and take in his 5 cars of oil at that time, and it would be much easier to the ship, in the condition she was in, to lie outside. As I say, the ground tackle, including the windlass and everything in connection with them, is not of the very best, and to stand off to sea sooner than lose that was her best way, better than to go back again and take the risk of their losing an anchor, or breaking a chain, or breaking a windlass; and such things will happen in all places, so the cheapest thing was to stand offshore. He did so. At the time that he was offshore his donkey, which was fitted out at San Pedro to burn oil for fuel, the pipes or connections gave out and he thought it would be better to go back to San Pedro, as probably the wind was westerly offshore and a greater current setting down that way through the channel, and he concluded to go to San Pedro and fix up the donkey, and he went down to San Pedro and did so.

The CHAIRMAN. What is the *Enoch Talbot*?

Mr. DORNFELD. She is a lumber bark, once used here to carry coal.

The CHAIRMAN. A ship?

Mr. DORNFELD. She is an American-built bark.

The CHAIRMAN. About what tonnage?

Mr. DORNFELD. Well, about such a thing as 1,200 tons. They used her in the coal trade until she got so she wouldn't carry coal, and then they put her in the lumber trade, and then put in an oil tank and fitted her up with an oil tank, and now she is lying at Oakland Creek waiting to go where the rest of them go.

Mr. BURR. Do I understand the first part of your statement, that a strong southeast wind would raise a southeast sea—that is, a sea which comes in from the southeast—of any magnitude?

Mr. DORNFELD. You have reference to Santa Monica?

Mr. BURR. I understood you to say that a strong southeast wind would bring in a southeast sea to Port Los Angeles?

Mr. DORNFELD. No, sir; not to Port Los Angeles.

Mr. BURR. Your answer was a general one?

Mr. DORNFELD. I understood it, yes, sir, to be a general question.

Mr. BURR. Your opinion, then, does not apply to Port Los Angeles?

Mr. DORNFELD. To a certain extent; there is a short southeast swell coming in there. There naturally would be. A gale of wind—a southeast gale—would clearly be bound to create a disturbance.

Mr. BURR. Is that at all troublesome?

Mr. DORNFELD. We have not found it so. Of course, we have not had much experience. We have probably such a thing as two or three southeasters during the time I have been down to Port Los Angeles, and, with the exception of once, in the *Dunboyne* case, I can't say we have had any real trouble from southeast seas.

Mr. BURR. Have you ordered off any other ship than the *Enech Talbot*?

Mr. DORNFELD. No. I would like to answer that in regard to the *Enech Talbot*. The *Enech Talbot* was not nearer Santa Monica than probably 11 miles. I went out in a towboat of mine to meet her. Being the pilot for the port, I did not know but what it was a bound vessel; so I went off probably 11 miles out to sea from Santa Monica, where I spoke her, and when I found who she was I told them to keep offshore.

Mr. BURR. You never ordered any other vessel off?

Mr. DORNFELD. No, sir.

The CHAIRMAN. Do I understand you to testify that you did that because of the telegraphic advices that you had that you were going to have bad weather and you thought she had better keep out to sea than to come inside?

Mr. DORNFELD. That was my view of it. I would like to mention that since that time we have regular advices from the office at the wharf of any unusual disturbances on the coast.

Mr. RODGERS. On the northern coast we have well-defined southeasters. I would like to ask you what is the average duration of a southeaster here at Santa Monica.

Mr. DORNFELD. Probably twelve hours, I judge.

Mr. RODGERS. What period of the time from the commencement is the sea heaviest, and where does it come from?

Mr. DORNFELD. I judge about after it has been blowing six or eight hours it would be heaviest.

Mr. RODGERS. Well, do you not have a sea coming without any local wind?

Mr. DORNFELD. Lots of it; lots of sea. That is what I mean. Quite often we have no wind for three or four days or a whole week, and still quite a swell would start in. Speaking generally, both here and at other ports below us that has been my experience. This heavy southwest swell starting in. A swell is what we call it.

Mr. RODGERS. Southwest?

Mr. DORNFELD. Yes, sir.

Mr. RODGERS. On the northern coast it is southwest altogether and lasts about three days, but here you think it lasts about twelve hours?

Mr. DORNFELD. No, sir. You asked me about Port Los Angeles. I have seen southeasters in this section last several days. I have only experienced two or three southeasters here at Port Los Angeles. I don't wish you to understand that. It is a hard thing to draw the line and say just how long a storm lasts when southeasters don't come often enough in this southern section to form any kind of an average. We only get two or three a year, and they are not all alike. I could write down no phases or figures and say it lasts so long or so long. My experience on the northern coast has been that the wind blows almost as hard after it shifts around to the southwest as it did from the southeast.

Mr. MORISON. The shorter swell that you say comes from the southeast would be the one that would affect smaller craft much more than they would large?

Mr. DORNFELD. They would, naturally; yes, sir. I think the southwest swells at every place are the dangerous seas to the shipping. I think it is after they shift from the southeast to the south-southwest when the danger comes in to the shipping.

Mr. BURR. Mr. Hood, I want to ask you whether, during the course of your experience prior to and during the construction of the wharf, you made any observation as to the change in direction of the heavy southwest swell—how much it varies from one point to another?

Mr. HOOD. In our observations before the construction of the wharf, we never had one. That is, we never had a storm swell such as Captain Dornfeld has described. We had the ordinary westerly swell, which was about south 42° $24'$ west, in this direction, you know [indicating].

Mr. BURR. Did you make any observation at any time showing how much the heavy southwesterly swell would vary in direction?

Mr. HOOD. During storms?

Mr. BURR. At any time.

Mr. HOOD. Yes, sir. Observations by which we obtained this direction of south $42^{\circ} 24'$, magnetic. As I remember it, for a month or two we made observations several times in the month, perhaps twenty or thirty times in the month. I have a map at home which I didn't care to cumber this discussion with which shows all the directions of the swell that were clearly defined at all. I had men on the bluff, on the shore on the points of approach, and we found the greatest variety, as near as I can recall it, within a few degrees. We found nothing that would inconvenience ships at the wharf unless they were end onto it, and only what you might call cyclonic swell, or swell with the roll southwesterly, as located here. As to that, we never took any observation, because there was no swell after the wharf was built, or any portion of it, that would cause us to change the direction of the wharf, since it was built.

Mr. BURR. Then, for instance, you say that the heavier swells, including the storm swells, so far as your observation goes, come from about south 30° west, or south 42° ?

Mr. HOOD. Yes, sir. I should say that the storm swells were never far from south 30° west. But I have never known a hard storm swell at Santa Monica that came as far northward as south 42° west. It may have happened, but I never heard and never knew of it. They are about south 30° west, or 35° west, or approximately that. After averaging them up, we have taken south 30° west as the usual storm direction at Port Los Angeles. That is the swell that comes in from the open ocean. That originates there. Of course you know that the southeasters we have here are really southwesterly gales far enough out, and are simply modified by the mountains of lower California.

Mr. HOOD. I will now introduce Mr. J. S. Slauson, a citizen of Los Angeles, who has asked for a few moments of your time.

Mr. SLAUSON. Mr. Chairman and gentlemen, I will be brief in what I want to say. I was one of the incorporators and a director in the Santa Monica Railroad from its incorporation until it was sold out to the Southern Pacific Railroad Company. I just want a minute of personal explanation. At that time I was opposed by the Southern Pacific Railroad and lauded by the friends of Santa Monica as a good citizen. I am in the anomalous position now of being abused by citizens of Los Angeles and the friends of San Pedro for the friendship of the Southern Pacific Company, yet all the time I have been just in one and the same position. We believed that there was a better port for Los Angeles than San Pedro. We built the railroad to Santa Monica, and we put out a pier there, and there were not any of us that knew much about pier building, or about waves, or undertows, or cutting under, or anything of the sort. We believed a wharf could be put out there and we put it up, and for the whole time that that wharf stood, before the ownership by the Southern Pacific Railroad, there were only two times that any of the coast line of steamers, and they were the only ones that came there, failed to make connection with the wharf and discharge their cargo and receive their cargo. These are facts, and the same facts exist now that existed then, and the same reasons for my being the friend of Santa Monica exist now as existed at that time. I don't suppose you will put it there because I think so. But there are certain reasons which you may not think pertinent that I wish to urge before you. The same reasons existed then that made the passenger fare from Santa Monica to Los Angeles \$1, when prior to that time it had been \$2.50 from San Pedro. That is a fact that establishes something, anyway. I think it is a cheaper way of getting fares, or else they were getting too much before that time. There was a large history in the little space of time that we have been here. I have been here twenty-two years. Los Angeles was but little larger than Santa Monica is now. We are here together, the citizens I am speaking of, and you and I are building a great city here, and it will extend that way [pointing toward Santa Monica]. Just as Bishop Berkeley said: "Westward the star of Empire goes"—and the biologist, the naturalist, and the philosophers of the earth can not tell the reason for it; but it exists. There is no use of expert testimony on that question, and I want to give you the plain facts as a citizen of this town. You are not building this harbor for to-day, or for next year, or for the next decade, but it is for the future, and I wish to say that this city is in its infancy, and in twenty years after its being built you would have to go around by San Pedro and come up here and go down toward Santa Monica, whither the city is tending. That is one thing I want to ask you to look at, and to take the map of this city and see the tendency of it and get the history of it from some of the citizens that know. There is another thing. I don't know whether these different companies will do it for you, but I wish you would call upon the Southern Pacific Company and the Terminal Company and the Santa Fe Company and the electric line for a statement of the passengers that are carried to and from San Pedro, and a statement of the number

carried to and from Santa Monica during the year, or any month in the year, and compare them, and see where that will land you.

Mr. MORGAN. How long was it after you completed that wharf that you speak of, that you were the original proprietor of, as I understand you, before you sold it to the Southern Pacific Company—how long after it was built?

Mr. SLAUSON. I think about a year and a half after its completion; it was sold.

Mr. MORGAN. That is the length of time of which you speak with respect to accidents?

Mr. SLAUSON. Yes, sir.

The CHAIRMAN. What was the date of the construction of the pier?

Mr. SLAUSON. It was begun early in 1876—no, the latter part of 1875, if I remember rightly.

The CHAIRMAN. What were the class of vessels that came there; how heavy were they?

Mr. SLAUSON. I think there was nothing particularly large, except lumber vessels and coast steamers. No large steamers that I remember of.

The CHAIRMAN. What is the depth of the water there?

Mr. SLAUSON. I forget that now.

Mr. MORISON. The Pacific Coast Steamship steamers are of two classes, large and small. Did both classes of steamers stop at your wharf?

Mr. SLAUSON. The *Orizaba* was the largest steamer of the Pacific Coast line at that time, and she was on there all the time.

Mr. MORISON. She stopped regularly?

Mr. SLAUSON. Yes, sir.

Mr. HOOD. Gentlemen, will you allow me to answer Mr. Rodgers's question as to the depth of the water at the old wharf?

The CHAIRMAN. Yes, sir.

Mr. HOOD. I will simply say that it is shown accurately in the position located on the sundry charts and it can easily be answered. It will be evident to you gentlemen, that of the sundry railroad interests at Santa Monica, there is the Santa Fe Railroad, the Southern Pacific Railroad, and the Pasadena and Pacific Electric Railway. There has been an examination made on this subject by Mr. Calvin Brown, a civil engineer of great experience in dock and light-house work, and in fact very great experience in engineering works connected with harbors and the like. Mr. Calvin Brown was jointly employed by the Southern Pacific Company and by the Pasadena and Pacific Electric Railway Company to write a report. He was obliged to go home, and this report should properly be presented by Mr. Clarke, the president of the Pasadena and Pacific Electric Railway Company, but as Calvin Brown is a joint employee of the two companies I will, with your permission, present his report without reading it, as there is no use in taking up your time, and that will be Mr. Brown's presentation.

Now, if I can say a word to you, before introducing anyone else, perhaps it will shorten this whole matter, at least on our side of the proposition. With your permission, I would like to say that we are well aware that there are sundry interests at Santa Monica and San Pedro besides the Southern Pacific. There are at San Pedro the Los Angeles Terminal Company's interests, the Southern Pacific Company's interests, and individual interests, real estate interests, merchants, saloons, restaurant keepers, everybody who has any interest there. At Santa Monica, the Santa Fe System, the Southern Pacific System, the Pasadena and Pacific Electric Railway Company, real estate owners, saloon keepers, merchants, and others. Perhaps one of the particular interests there is the restaurant interest, as it is a resort. It was rather seriously stated in one of the papers recently that Mr. Robert Eckert, who keeps a very favorably known restaurant with a saloon attached, as a resort furnishing fish, razor clams, and other things, would appear here. This was an error. I would really like to have him. But I think the remark that was made in the same paper in reference to Mr. Eckert's appearance is appropriate in reference to all interests at either point. With your permission, I will read it and present no one else on our side, and close our side of the case in this first hearing, provided no one else wishes to appear. If no one requests to appear here, I will not present anyone else at present. The paper reads as follows:

"Undoubtedly Bob Eckert is thoroughly and sincerely desirous of having the deep-water harbor as near his oyster house as possible. He needs that harbor in his business. It will bring customers to his restaurant. This cogent argument has never been sufficiently considered by the people of southern California, but Bob, with Engineer Hood's aid, will present it to the Board."

We desire to present to-morrow the testimony or affidavits of three captains, one being Captain Alexander of the *Santa Rosa*, another Captain Waldeck of the *Alcasar*, who will be here at 10 o'clock to-morrow.

The CHAIRMAN. The hearing stands adjourned until 10 o'clock to-morrow.

THIRD DAY.

DECEMBER 23, 1896.

The Board reconvened at 10 a. m., all members being present.

Mr. HOOD. Mr. Chairman and members of the Board, I would like to present Captain Alexander, of the Pacific Coast Steamship Company's steamer *Santa Rosa*, who does not come here to favor either harbor. In fact, he has distinctly declined; but he has come here at our request, because we know that he is well known to every one in Los Angeles County as an experienced sea captain, and one whose opinion would perhaps on some matters be of value to your Board.

The CHAIRMAN. How many years have you been on this coast?

Captain ALEXANDER. Twenty-three years in steamships.

The CHAIRMAN. How many years have you commanded ships?

Captain ALEXANDER. Thirty years.

The CHAIRMAN. Have you commanded ships on this coast twenty-three years?

Captain ALEXANDER. Steamers twenty-three; sail two.

The CHAIRMAN. Will you mention some, or all, of the steamers you have commanded?

Captain ALEXANDER. Well, I am in command of the *Santa Rosa* now. I have commanded the *Queen of the Pacific*, the *Mexico*, *Idaho*, the *Ancon*, the *Orizaba*, the *San Luis*, the *Los Angeles*, the *Constantine*—oh, I give it up; there are so many of them.

The CHAIRMAN. Will you tell us what you know about the harbor of Port Los Angeles as a harbor for steamers?

Captain ALEXANDER. Well, I have been running now three years and a half to Port Los Angeles, and I have made, I suppose, some three hundred landings in the three years and a half, taking freight and passengers there, and have always landed the ship there, docked her at the dock and made fast to the dock, discharged the freight and passengers and left on time; and the same coming back from San Diego. I have never, so far as discharging freight and passengers is concerned, had any difficulty, and I think in my experience there I have only parted three lines. I think we parted our breast line twice and our head line once. As far as that is concerned, we have always left on time.

The CHAIRMAN. Is there any particular difficulty in discharging and receiving cargo?

Captain ALEXANDER. Well, we have not found it so. Of course, it is not as smooth there as it would be in, say, San Diego, but it is a good deal smoother than I have seen it in San Francisco at times with a heavy norther or southeaster blowing.

The CHAIRMAN. How is the holding ground?

Captain ALEXANDER. That I couldn't say.

The CHAIRMAN. You never anchor there?

Captain ALEXANDER. Never anchored.

Mr. MORISON. Since you have been landing at Port Los Angeles have you been accustomed to land at San Pedro?

Captain ALEXANDER. No, sir.

Mr. MORISON. Before you landed at Port Los Angeles you were accustomed to go to San Pedro?

Captain ALEXANDER. Yes, sir.

Mr. MORISON. With the same ship?

Captain ALEXANDER. Yes, sir; ran the *Santa Rosa* there a year or two.

Mr. MORISON. How did you handle your business at San Pedro?

Captain ALEXANDER. In lighters.

Mr. MORISON. You anchored the ship?

Captain ALEXANDER. Yes, sir.

Mr. MORISON. How was the holding ground?

Captain ALEXANDER. The holding ground was not the best or not the poorest, I would say. You would not call it the best. I have anchored vessels in better and in poorer holding ground.

Mr. MORISON. Can you take the pointer and show on that map where you were accustomed to anchor at San Pedro?

Captain ALEXANDER. We used to lay at anchor here [showing on map].

Mr. MORISON. That is, your lay west of the inner harbor?

Captain ALEXANDER. South of the inner harbor.

Mr. MORISON. South of the entrance to the inner harbor?

Captain ALEXANDER. Yes, sir; some times south and east. Of course, we didn't anchor always just in the same place, but that is about the place we used to lay at anchor.

Mr. MORISON. You landed as close as you could?

Captain ALEXANDER. Yes, sir; we used to anchor east, where it was smoother. At times, when I run the *Ancon*, I used to anchor here [indicating].

Mr. MORISON. When you were on the *Ancon*, the jetties were not built out as far as they are now?

Captain ALEXANDER. No; there were no jetties there to amount to anything when I was on the *Ancon*.

Mr. MORISON. What was the objection to anchoring farther east?

Captain ALEXANDER. I know of none. Of course, you would want to be as handy to the entrance as possible, and you are closer under the west shore here, farther over this way [indicating].

Mr. MORISON. Which way does the swell come from at San Pedro?

Captain ALEXANDER. The swell would be governed by the winds; but the heaviest swells come from the south and west, southwest to south, down in by Point Firmin [showing on map]. About southwest, southwest by south.

Mr. MORISON. How heavy a swell would you get from the southeast at San Pedro?

Captain ALEXANDER. I don't know as I ever saw very much swell from that direction, but I have seen a rough, choppy sea.

Mr. MORISON. Was it a sea that would disturb you if you were lying at anchor?

Captain ALEXANDER. It would not have the effect on the ship lying at anchor that a heavy swell or an undertow would; but from the southeast I don't know that I ever saw any real heavy swell come in there.

Mr. MORISON. It was enough to stop handling cargo?

Captain ALEXANDER. Lots of times.

Mr. MORISON. But not enough to make you feel anxious so far as your anchors were concerned?

Captain ALEXANDER. No; I was under steam, and could put out to sea.

Mr. BURR. Suppose your engines had been cold?

Captain ALEXANDER. That would be a different proposition. I left the evening before two ships went ashore. I left in the evening, and the next morning they went ashore—the *Keweenaw* and *San Luis*; and I believe the *American* was another one. I left the night before they went ashore. They went ashore some time in the night or the next morning.

Mr. BURR. You didn't see them go ashore?

Captain ALEXANDER. No, sir; they were piled up when I got there.

Mr. BURR. They went ashore before you got there?

Captain ALEXANDER. No; when I got back the next time they were ashore.

Mr. BURR. In your present run down the coast, what ports do you make?

Captain ALEXANDER. Port Harford, Santa Barbara, Port Los Angeles, Redondo, and San Diego.

Mr. BURR. Of course San Diego is a closed harbor?

Captain ALEXANDER. Yes, sir.

Mr. BURR. Of the other four, which is the best to land at?

Captain ALEXANDER. Well, of course that depends on winds; but at Santa Barbara you can land oftener than any place we land.

Mr. BURR. That is the best place?

Captain ALEXANDER. That is the best; yes, sir. There is no question about that. I never missed Santa Barbara in my life. So far as that goes, I never missed Port Los Angeles.

Mr. BURR. Do you go to the pier at Santa Barbara?

Captain ALEXANDER. Yes, sir; lay at the pier.

Mr. BURR. You have been running to Santa Barbara for twenty years?

Captain ALEXANDER. Oh, no; not Santa Barbara. I have been running to Santa Barbara about thirteen years, and the rest of these ports thirteen years. I ran north a long time to Puget Sound and the Columbia River.

Mr. BURR. During those thirteen years you have never missed landing at Santa Barbara?

Captain ALEXANDER. Never, sir.

Mr. BURR. During the three years and a half you have never missed landing at Port Los Angeles?

Captain ALEXANDER. No, sir.

Mr. BURR. How about the other ports—Port Harford and Redondo?

Captain ALEXANDER. I never missed Port Harford but once, that is three years ago to-day. I arrived there and couldn't land, and came on to Santa Barbara. That was in December, 1893.

Mr. BURR. How about Redondo?

Captain ALEXANDER. Well, I have passed Redondo, I think, only twice. I left there two or three different times after I landed the passengers. Those winds are west winds.

Mr. BURR. How long have you been landing at Redondo?

Captain ALEXANDER. I think it is about six years.

Mr. BURR. Then, in a general way, you consider Santa Barbara the best landing, Port Los Angeles next, and the other two next?

Captain ALEXANDER. As far as that is concerned I have found it so. That is my experience, because I never missed either one of those places, and the other places I

have. Of course that lies with your honorable Board to decide which would be the best.

Mr. BURR. I am asking your opinion.

Captain ALEXANDER. Well, I merely state the facts, and it lies with the Board to determine.

Mr. BURR. The pier at Port Los Angeles you would consider an excellent pier?

Captain ALEXANDER. It is; yes, sir.

Mr. BURR. You would consider you could tie up to that pier when you could not tie up to a poorer pier?

Captain ALEXANDER. I think so, although I do not know. The piers at Santa Barbara and Port Harford are not braced at all. It has always been a great question which is the best wharf to build, one solid or one that would give with the ship. The wharves at the other ports give with the ship when they strike it, but the wharf at Port Los Angeles is firm. It is like lying alongside of a ledge.

Mr. BURR. Santa Barbara is not firm?

Captain ALEXANDER. No, sir; nor Port Harford. They are not braced at all. When the ship strikes, the wharf gives. The wharf will sway back and forth a foot sometimes when it is rough, but not when it is smooth.

Mr. BURR. How does the amount of swell compare at Port Los Angeles with Santa Barbara?

Captain ALEXANDER. Well, at Port Los Angeles you get more undertow and swell than you do at Santa Barbara.

Mr. RODGERS. Have you ever met with any damage to your ship at either place while alongside the wharf?

Captain ALEXANDER. Yes; on the last trip coming down at Port Harford I took one hit out and the capstan. I don't know where that is. I haven't seen it since. We parted all our lines.

Mr. RODGERS. How about Port Los Angeles?

Captain ALEXANDER. We landed there and laid there on a string; didn't make fast to the buoys.

Mr. RODGERS. This occurred at Port Harford?

Captain ALEXANDER. This was Port Harford.

Mr. RODGERS. How about Santa Barbara?

Captain ALEXANDER. It was the heaviest swell I ever saw at Santa Barbara. The owner of the wharf, or rather the manager, Mr. Smith, says he never saw such a sea there since the wharf was built, though there hadn't been a breath of wind for twenty-four hours.

Mr. RODGERS. How did it compare with Port Los Angeles that day?

Captain ALEXANDER. It was worse at Santa Barbara that day than at Port Los Angeles. I never saw anything like it before.

Mr. RODGERS. You came south then?

Captain ALEXANDER. I left Santa Barbara at 6 p. m. and got in Port Los Angeles at 11.30.

Mr. RODGERS. At night?

Captain ALEXANDER. At night; yes, sir.

Mr. RODGERS. And there was less swell at Port Los Angeles?

Captain ALEXANDER. Yes, sir; a good deal less swell.

The CHAIRMAN. Is the kelp at Santa Barbara ordinarily smoother than at Port Los Angeles?

Captain ALEXANDER. Yes, sir; no question about that.

The CHAIRMAN. Captain, comparing Port Los Angeles with Redondo, at which wharf is there the least swell or undertow?

Captain ALEXANDER. There is the least undertow at Redondo; there is no undertow at all at Redondo.

The CHAIRMAN. Which has the least swell?

Captain ALEXANDER. Well, Port Los Angeles is more protected from the west wind than Redondo is. That is where Redondo has her worst time, with westerly gales.

The CHAIRMAN. And I suppose with the prevailing northerly summer winds?

Captain ALEXANDER. Yes, sir.

The CHAIRMAN. Those winds blow what portion of the time?

Captain ALEXANDER. I suppose you might land at Redondo three hundred and fifty days out of the year.

The CHAIRMAN. You misunderstand the question. What portion of the time do you have northwesterly and westerly winds?

Captain ALEXANDER. They start in the month of April down here and last until August. Of course they are the strongest in the months of April, May, and June.

The CHAIRMAN. During that time Redondo is not as good a landing place as Port Los Angeles?

Captain ALEXANDER. If you have got a heavy westerly gale it would not be, because I have left Redondo and been to Port Los Angeles and found the difference.

The CHAIRMAN. Which wharf does your ship lay the quietest at, Redondo or Port Los Angeles?

Captain ALEXANDER. She lays the quietest at Redondo. She is easier on her lines at Redondo than she is at Port Los Angeles.

Mr. RODGERS. Captain, did you ever make landing at the old wharf at Santa Monica?

Captain ALEXANDER. I was there twice, I think. That wharf was built twenty-three years ago. I think I was there to take the last ties to finish the road in the steamer *Monterey*, and I was there once with the *Los Angeles* afterwards.

Mr. RODGERS. Then you didn't make landings enough there to have any opinion as to the relative—

Captain ALEXANDER. No, sir.

Mr. RODGERS. In your experience along the coast have you ever had occasion to observe any shore currents to the westerly or northerly along the shore?

Captain ALEXANDER. Oh, yes. There are more or less currents all along the coast.

Mr. RODGERS. Close inshore?

Captain ALEXANDER. Close inshore; yes, sir.

Mr. RODGERS. In what direction?

Captain ALEXANDER. Well, the currents tend with the coast; either up or down the coast, as the coast lies.

Mr. RODGERS. You have observed them in both directions?

Captain ALEXANDER. Yes, sir.

Mr. RODGERS. Have you observed those currents at either Port Los Angeles or San Pedro?

Captain ALEXANDER. I have, at San Pedro; but I have never seen any current at Port Los Angeles at the wharf.

Mr. RODGERS. When you were at anchor or have been anchored at San Pedro, have you observed any shore current there?

Captain ALEXANDER. Yes, sir.

Mr. RODGERS. In which direction?

Captain ALEXANDER. I have seen it set to the west, or east, you might say, as the coast shows—both ways. In the winter time I have seen the ship lay southeasterly all day; in the trough of the sea all day long.

Mr. RODGERS. Sometimes in one direction and sometimes in another?

Captain ALEXANDER. Yes, sir.

Mr. MORISON. The ship lay easterly, the wind being southeasterly?

Captain ALEXANDER. Yes, sir.

Mr. MORISON. The current took the ship east?

Captain ALEXANDER. The current swung her stern to the west.

Mr. MORISON. The same way as the wind?

Captain ALEXANDER. She was headed southeast. Sometimes she was heading about east, stern to the westward, and more than that. She laid almost broadside to it all day. That was in 1891. Colonel Mendell and Colonel Benyaud were aboard the ship at the time.

Mr. MORGAN. Stating the proposition generally, the shore current is up the coast and not down the coast?

Captain ALEXANDER. Well, of course that is the supposition all along the Pacific Coast. It has been decided that in the summer time there is a current sets up the coast.

Mr. MORISON. How is it in the winter time?

Captain ALEXANDER. In the winter time it is supposed to be vice versa.

Mr. MORISON. Supposed to go down the coast?

Captain ALEXANDER. That is the supposition; that is what the survey gives us, the pilot book.

Mr. MORISON. What is your experience?

Captain ALEXANDER. Well, that has been my experience.

Mr. BURR. Were you ever anchored at Santa Barbara when the current was in the other direction?

Captain ALEXANDER. Yes, sir; we used to lay there, and the ship would be swinging to the current. It would be to the westward and then to the eastward. We placed a mooring there to hold the ship so we could discharge into lighters. We had to do that for years; put a line to the stern to keep her from swinging with the tide.

Mr. BURR. Did you ever find it so rough at San Pedro you could not land there?

Captain ALEXANDER. Yes, sir.

Mr. BURR. You carried the passengers by?

Captain ALEXANDER. I don't know that I carried the passengers by. I lay there thirty-six hours once to get them aboard ship; but I think I have never carried them by, but I have carried freight by some two or three times; may be more.

Mr. BURR. It has been too rough to land freight?

Captain ALEXANDER. Yes, sir; we used to arrive there early in the morning. We

would get our passengers off and may be the perishable goods also. I remember in 1891 we didn't get anything off but passengers.

The CHAIRMAN. That was the *Santa Rosa*?

Captain ALEXANDER. Yes, sir.

The CHAIRMAN. How much does the *Santa Rosa* draw?

Captain ALEXANDER. She draws about 17½ feet aft.

The CHAIRMAN. Did you ever take her into the inner harbor?

Captain ALEXANDER. No, sir.

Mr. BURR. Did you ever drag anchor at San Pedro?

Captain ALEXANDER. Yes, sir.

Mr. BURR. Many times?

Captain ALEXANDER. Not many times. I don't think it was the fault of the holding ground as much as it was that we didn't give her chain enough. There is a place in the west side of the anchorage that is hard bottom. I have anchored there and have dragged. There used to be about 18 feet of water there. The bottom is sandstone or something.

Mr. RODGERS. From your experience in lying at San Pedro as you have done, where would be a good place to build a wharf?

Captain ALEXANDER. You mean outside?

Mr. RODGERS. Outside.

Captain ALEXANDER. That I do not know. You mean if I was going to build one for myself?

Mr. RODGERS. I merely want to get your judgment of what would be the proper location for a wharf.

Captain ALEXANDER. That is not for me to say. I guess the Board better decide that. They can take the testimony.

Mr. MORISON. If you were going to have a wharf built by somebody else for you to land your steamer at, what would you say?

Captain ALEXANDER. They could build it where I had the most interest so far as I am concerned.

Mr. RODGERS. Do you think a wharf could be built out from Rattlesnake Island south of the jetties where a ship could lie comfortably?

Captain ALEXANDER. Well, of course I could not say. It is pretty hard to tell. It has been the test of building wharves on the coast at open roadsteads that you can hardly tell the results until you build them. When I first went to Port Los Angeles I didn't suppose I could lie there, and said so; but nevertheless I have been going there every four days for three years and a half and landed there every time. But I didn't think we could. I made that statement to our people in San Francisco. That was my judgment so far as that was concerned.

Mr. RODGERS. I want to ask a question. Are you in command of the *Santa Rosa* now?

Captain ALEXANDER. Yes, sir.

Mr. RODGERS. How much does she draw?

Captain ALEXANDER. Seventeen feet and a half.

Mr. RODGERS. What is the least amount of water you would consider necessary to have under her bottom at Port Los Angeles to keep her clear of the ground?

Captain ALEXANDER. Two feet and a half.

Mr. MORISON. Would that provide for the swell?

Captain ALEXANDER. It would while I have been there.

Mr. MORISON. You are willing to land in 20 feet of water, then, with the swell?

Captain ALEXANDER. Yes, sir.

Mr. MORISON. How about Santa Barbara?

Captain ALEXANDER. It would be the same there. They have only got about 20 feet at Santa Barbara or 21 feet. There ain't 21 feet at low water.

Mr. MORISON. Is Port Harford the same?

Captain ALEXANDER. I think Port Harford is a little deeper than Santa Barbara. The ship don't rise and fall there much.

Mr. RODGERS. Do I understand you to say you would be willing to have 2 feet of water under the ship in all the harbors?

Captain ALEXANDER. Not all of them.

Mr. MORISON. How about San Pedro?

Captain ALEXANDER. I suppose that would be about the same as Port Los Angeles, Santa Barbara, and Port Harford.

Mr. RODGERS. That strikes me as being a very small margin.

Captain ALEXANDER. It would be owing to how much swell you had.

Mr. RODGERS. It is the swell I want to get at.

Captain ALEXANDER. My experience when I ran to Portland over the Columbia River bar is that we considered 2½ feet of water under the ship enough water to take her in. We did it time and time again. When the ship was drawing 20 feet the pilot would start over the bar with 22 feet, but not when it was rough.

Mr. RODGERS. Would you be willing to lie on the bar continuously?

Captain ALEXANDER. At Santa Barbara and Port Los Angeles we don't rise a foot up and down the wharf.

Mr. RODGERS. At any other port?

Captain ALEXANDER. At any of these ports. We don't raise up and down a foot.

The CHAIRMAN. You are speaking of lying alongside a pier?

Captain ALEXANDER. Yes, sir.

The CHAIRMAN. If you anchored at Santa Barbara, would you lie at anchor in more water?

Captain ALEXANDER. Of course.

The CHAIRMAN. How much water would you be willing to anchor in in either of these three places?

Captain ALEXANDER. If I was coming to anchor in San Pedro if it was rough I would want 25 feet. I suppose I would in any of the other places, or 25½. I would want more really if I could get it, but I would not be afraid to anchor a ship drawing 17½ feet in that depth.

Mr. RODGERS. How much chain would you want, supposing you were anchored at Port Los Angeles in 8 fathoms? How much chain would you want to let out, taking the weather as you find it?

Captain ALEXANDER. We would lie with about 30 to 35 fathoms, ordinary weather. I have had out 70 fathoms at San Pedro.

Mr. RODGERS. Was the wind blowing?

Captain ALEXANDER. Yes, sir; a strong southeaster.

Mr. RODGERS. One anchor down?

Captain ALEXANDER. One anchor down; yes, sir.

The CHAIRMAN. How many lines of breakers were there when you went over the Columbia River bar with 2½ feet under you?

Captain ALEXANDER. How many would the ship take at one time?

The CHAIRMAN. No; how many were there on the bar?

Captain ALEXANDER. Well, there were about four or five or six; I couldn't tell; may be half a dozen. The outer breaker would be the heaviest. When we used to do that, the bar was not breaking heavily.

The CHAIRMAN. When it was breaking heavily you would not go across at all?

Captain ALEXANDER. No, sir. The old pilot used to figure on 2 feet when I was in the *Queen*. She was the best bar ship the company had. She would rise and fall less than any of them.

The CHAIRMAN. Have you noticed a westerly current with summer winds from the westward, and has the ship lain up against westerly winds?

Captain ALEXANDER. At which place?

The CHAIRMAN. At any of these places.

Captain ALEXANDER. Yes, sir—well no, I have not at Port Harford. There is no current at Port Harford; but outside of that point there is lots of current, and I have experienced but a little current at Santa Barbara. There is some there. I have seen in San Pedro a current setting to the westward. The ship swings with it. We used to call it "swinging with the tide" at San Pedro. Of course everybody that runs to San Pedro knows that.

The CHAIRMAN. There is a strong current making in and out of Wilmington Harbor which affects the ship?

Captain ALEXANDER. If you laid in the line of it, I suppose it would, still it should not be strong enough to reach away up by Point Firmin.

The CHAIRMAN. How about the current at Port Los Angeles?

Captain ALEXANDER. I have never experienced any current at Port Los Angeles; not at the wharf.

Mr. MORISON. There is a very much stronger current at San Pedro than at Port Los Angeles?

Captain ALEXANDER. I never experienced any current at Port Los Angeles at all. I land the ship at night coming down and never found any current. If there was much current we would have found it out.

Mr. BURR. Have you observed any current at Redondo?

Captain ALEXANDER. Yes, sir.

Mr. BURR. In both directions at different times?

Captain ALEXANDER. In both directions at different times.

Mr. HOOD. Captain Alexander has to catch the *Corona* and go up to Santa Barbara and take the *Santa Rosa*, so you will excuse his leaving the hall.

The CHAIRMAN. Certainly.

Mr. HOOD. Mr. Chairman and members of the Board, I will present Captain Johnson, of the *Whitesboro*, who will answer any question that you choose to put to him.

The CHAIRMAN. Captain, how long have you been running on this coast?

Captain JOHNSON. About twelve or thirteen years.

The CHAIRMAN. What are you doing now—what are you on?

Captain JOHNSON. I am master of the steamer *Whiteaboro*.

The CHAIRMAN. Running where?

Captain JOHNSON. Running on the northern coast and southern coast both, carrying lumber.

The CHAIRMAN. What do you know about Port Los Angeles?

Captain JOHNSON. I have been there about a dozen times, at different times, and always discharged cargo.

The CHAIRMAN. Did you have any difficulty there?

Captain JOHNSON. No, sir.

The CHAIRMAN. Always been able to land without trouble?

Captain JOHNSON. Yes, sir.

The CHAIRMAN. Always landed your passengers and freight?

Captain JOHNSON. Passengers I didn't carry, but always landed freight. It mostly consisted of lumber. We lay close to the wharf.

The CHAIRMAN. Have you ever met with any accidents there?

Captain JOHNSON. No, sir.

The CHAIRMAN. Had no difficulties?

Captain JOHNSON. No, sir.

The CHAIRMAN. Do you know San Pedro also?

Captain JOHNSON. I have been in San Pedro several times.

The CHAIRMAN. How many times?

Captain JOHNSON. I couldn't tell exactly; probably half a dozen times. I have been there once since I was master of this boat. I used to go there when I was mate.

The CHAIRMAN. You went inside?

Captain JOHNSON. Yes, sir; in small vessels.

The CHAIRMAN. Have you laid outside at all?

Captain JOHNSON. Just merely dropped anchor and waited for the tide.

The CHAIRMAN. How large is the steamer you command?

Captain JOHNSON. One hundred and forty-five tons.

The CHAIRMAN. How much water does she draw?

Captain JOHNSON. Thirteen feet and a half, loaded.

The CHAIRMAN. What is the character of your usual freight?

Captain JOHNSON. Mostly railroad ties.

The CHAIRMAN. For whom?

Captain JOHNSON. For the company, the railroad company.

The CHAIRMAN. Which of these railroads?

Captain JOHNSON. The Southern Pacific. That is down to Port Los Angeles; up north we carried lumber to different parties.

The CHAIRMAN. When you came to San Pedro, whom have you brought freight for?

Captain JOHNSON. For the Southern Pacific Company.

The CHAIRMAN. Have you ever experienced any currents at all about Port Los Angeles?

Captain JOHNSON. No, sir.

The CHAIRMAN. Any about San Pedro?

Captain JOHNSON. Well, no; except tide set.

The CHAIRMAN. Which way was the set?

Captain JOHNSON. It was up and down the coast.

The CHAIRMAN. You mean to the westward or to the eastward?

Captain JOHNSON. I couldn't tell. I never laid at anchor in the outer harbor.

The CHAIRMAN. You only lay there to wait for the tide to get inside?

Captain JOHNSON. Just waited for the tide to get inside. We lay close in.

Mr. MORISON. How long is your steamer, Captain? What is the total length?

Captain JOHNSON. One hundred and fourteen feet, I believe.

Mr. MORISON. Quite a small boat?

Captain JOHNSON. A little boat, yes.

Mr. HOOD. Mr. Chairman and members of the Board, there are two captains that we expected that have not arrived. I shall not ask permission to present them hereafter, but the reason I wished those two captains was that they were men of experience with large ships and they were not in any way connected with the Southern Pacific Company; but as they have not come, in order to give you some opportunity to question still one other captain, who will be the last, I will present Captain Pillsbury, who is in fact essentially an employee of the Southern Pacific Company and might as well be so considered, although the routine is a little different. I had hoped to avoid the necessity of calling anyone in our employ, and I will present the question which at the proper time will give an idea of what I would like asked of him, as well as anything else you may wish.

The CHAIRMAN. How many years have you been running on this coast, Captain?

Captain PILLSBURY. About four years.

The CHAIRMAN. Commanding a vessel all the time?

Captain PILLSBURY. Yes, sir.

The CHAIRMAN. What do you command now?

Captain PILLSBURY. The steamer *Mineola*.

The CHAIRMAN. What is your usual freight?

Captain PILLSBURY. She is a collier now, sir. When I first came here in her she brought a general cargo from New York, and since then she has been employed in the coal business for the Southern Pacific.

The CHAIRMAN. Bringing coal to Port Los Angeles?

Captain PILLSBURY. And San Francisco.

The CHAIRMAN. What has been your experience at Port Los Angeles?

Captain PILLSBURY. We have never yet been detained in making a landing, and the only time we have been detained in discharging was in the night time when they first began work with the cranes. They had new crane drivers and track hands, and perhaps on one or two occasions they did stop in the night time; not in the day time, that I remember of.

The CHAIRMAN. You have never found any difficulty in landing and discharging at Port Los Angeles?

Captain PILLSBURY. No, sir. We have frequently come up the Santa Barbara Channel with a strong westerly gale shipping large seas on deck, and the first time (I think that was in February, 1894) I was very doubtful whether it would be safe to land or not, but we kept on, and as we got near the wharf it became smoother, and we had no difficulty in landing. On the last occasion before this (I think it was the 25th of November) there was quite a heavy gale in the Santa Barbara Channel. We came right in and landed without difficulty; commenced work at once, and continued without interruption.

The CHAIRMAN. Have you ever injured your ship in there at all?

Captain PILLSBURY. No, sir.

The CHAIRMAN. Have you been to San Pedro at all?

Captain PILLSBURY. Not with the ship; no, sir.

The CHAIRMAN. How large is the *Mineola*?

Captain PILLSBURY. Her carrying capacity is about 3,200 or 3,300 tons. She is 285 feet long and draws about 25 feet of water.

Mr. RODGERS. How much water do you consider it safe to have under the ship's bottom when you lie at Port Los Angeles?

Captain PILLSBURY. Ordinary times about 3 feet.

Mr. RODGERS. Do you think that would be sufficient in all swells?

Captain PILLSBURY. No, sir; I should not feel comfortable, perhaps, in a very heavy sea.

Mr. RODGERS. That is what I want to get at. What would you think safe in the heaviest swell you have seen?

Captain PILLSBURY. Perhaps 4 feet.

Mr. RODGERS. You never have taken the bottom there?

Captain PILLSBURY. No, sir.

Mr. RODGERS. In what depth have you laid?

Captain PILLSBURY. About 32 feet in the inner berth. We lie in the inner berth most of the time.

Mr. MORISON. Your ship is an iron ship?

Captain PILLSBURY. An iron ship.

Mr. MORISON. Where was she built?

Captain PILLSBURY. Sunderland, England.

Mr. MORISON. She is an English ship?

Captain PILLSBURY. No, sir, not now. She has been Americanized.

Mr. MORISON. Have you ever been at the Oakland Pier in San Francisco Bay?

Captain PILLSBURY. Yes, sir; many times.

Mr. MORISON. In a winter storm?

Captain PILLSBURY. No, sir; I have never experienced any storms at the Oakland Pier.

The CHAIRMAN. Have you been there when it was blowing hard?

Captain PILLSBURY. Oh, summer gales—fresh, westerly gales.

The CHAIRMAN. How does the motion there compare with the motion at Port Los Angeles?

Captain PILLSBURY. There is only a slight movement of the ship at Oakland. Of course, at Port Los Angeles with any sea the ship lifts up and down.

The CHAIRMAN. More motion at Port Los Angeles?

Captain PILLSBURY. Oh, yes, sir.

Mr. MORISON. Have you landed with your ship at any other ports on the southern coast?

Captain PILLSBURY. No, sir.

The CHAIRMAN. Have you noticed any currents at Port Los Angeles when you have been at the wharf?

Captain PILLSBURY. Yes, sir; I must say I have. Very frequently in docking we have noticed a slight current setting either up or down. We would notice it rather more than the other ships, because we come in head in, turn around in through the buoys, and swing around with a buoy breast line; from one-half knot to 1½ knots is probably the strongest current I have ever noticed.

Mr. MORISON. Which way would you say is the prevailing direction of that set; to the westward or eastward?

Captain PILLSBURY. I think, perhaps, I have noticed it as much one way as the other. There seems to be no regularity about it. One time it will be setting through the wharf to the southward and another time to the northwest.

Mr. RODGERS. Have you ever anchored at Port Los Angeles clear of the wharf?

Captain PILLSBURY. Yes, sir; we frequently arrive there in the nighttime and it is seldom we dock until morning.

Mr. RODGERS. In what depth of water?

Captain PILLSBURY. About 7 to 8 fathoms.

Mr. RODGERS. What length of chain do you lay out usually?

Captain PILLSBURY. Thirty fathoms.

Mr. RODGERS. Have you laid there in a gale of wind?

Captain PILLSBURY. No, sir; except on one occasion it blew a moderate gale from the westward, probably 35 miles an hour.

Mr. RODGERS. Didn't you use more chain than 30 fathoms?

Captain PILLSBURY. I think that is all she had out. The holding ground I found excellent. On one occasion we had difficulty in bringing the anchor up.

Mr. RODGERS. What is the bottom?

Captain PILLSBURY. Ordinary sand over clay. If your anchor goes in hard, it is difficult to bring it up.

The CHAIRMAN. Mr. Hood, Professor Burr wants to ask you one or two questions.

Mr. BURR. I want to ask two or three questions about that plot of land between the Santa Monica Canyon and the shore end of your wharf, which, I believe you stated yesterday, was owned by Mr. C. P. Huntington.

Mr. HOOD. Yes, sir; I believe it is. In fact, I am very confident it is, but I do not like to say I know it.

Mr. BURR. That is not essential to my point. Does that plot of land extend to the water front—that is, either to high or low water?

Mr. HOOD. It used to extend to the high-water line, according to my idea—that is, the tract of land as purchased by him. To the best of my remembrance it extends to the high-water line the same as other ownerships on Santa Monica Bay. There are no ownerships on Santa Monica Bay that I am aware of that extend beyond high-water line. But I may be mistaken as to that legal point. The ground occupied by the railroad there is, as I remember it, 100 feet in width of right of way at that point. It is very much narrower on Jones's and Baker's, but on this land that Mr. Huntington bought I thought he would naturally give us anything we wanted, and I asked for 100 feet of right of way. I sent the deed on for signature, but I couldn't tell you at this minute whether when that deed came back it was signed by him as indicating that the property was in his name or signed by somebody else as indicating that it was in their name. I would have to look that up.

Mr. BURR. The point I want to get at now is, if it is a fact that that tract extends to high-water or low-water line?

Mr. HOOD. The high-water line, to the best of my knowledge, and our right of way is expressed as being 100 feet wide. I think it is 50 feet on each side of a center line of the main line of the track, and that takes it on one side up into the bluffs a little and some places to high water; sometimes beyond high water. Some places it does not go to high water. In fact, the high-water mark changes all the time.

Mr. MORISON. In case accretions should form in front of that, who do you understand would be the owner of those accretions?

Mr. HOOD. I have a general impression the ownership of such an accretion would be the owner of the land, but I am not an authority on that subject.

Mr. BURR. I suppose the ownership of this land carries title as far as private ownership can go?

Mr. HOOD. Yes, sir; and my impression is that our right of way takes practically all the ground in this place in front of Mr. Huntington's land from the center line of our track to high water, but I do not know. I have not taken any interest in it. It may, or may not; that can be investigated.

Mr. BURR. What is the length of frontage, as near as you can recollect, from the easterly limit of this plot to the commencement of your wharf—that is, to the land end of your wharf?

Mr. HOOD. I should think it was essentially 2,000 feet, but I will say that subject to any correction you find; I do not know; I can give you a plat of it if you like.

Mr. BURR. I didn't understand from the stenographer's report of your statement

whether the easterly limit of this plot was on the westerly edge of the canyon or whether it was on the easterly slope of the canyon; in other words, whether it includes the canyon or not.

Mr. HOOD. The easterly line of the Santa Monica Heights tract in that vicinity is on the sidehill which forms the westerly side of the canyon, and the Santa Monica Heights tract not only includes none of the canyon whatsoever, but the boundary line is pretty high on the hill. I should think it was perhaps 70 feet, vertical, right at the mouth of the canyon, and my impression is, a quarter of a mile up the canyon it is back pretty well on the terrace. At any rate, it includes none of the Santa Monica Canyon whatever, but the boundary line is up on the slopes which form the westerly boundary of the canyon.

Mr. BURR. Did you make any survey or reconnaissance for a railroad line up the Santa Monica Canyon?

Mr. HOOD. We made no instrumental survey that I remember up the canyon for a railroad. By that I mean we used a hand level and that kind of thing, but we did not make an instrumental survey with a chain, a transit, an engineer's level and rod. We made no such survey as that. It was looked over very carefully, simply for information and data, without the slightest reference to competing railroads or anything else. We had decided that the place for the wharf, in the absence of a protected harbor, was where we built it. We wanted to know the best way to get there, and we made a hand-level reconnaissance. I will not mention myself at all in this, but I have some assistants who have worked under my direction for twenty-one years that can get a result that tallies better with the final result in that way than many engineers can with the level, chain, and transit.

Mr. BURR. Did you have data enough from that reconnaissance to make at least a rough estimate of the grade that would be required to get up the canyon?

Mr. HOOD. Yes, sir; we found that we could use, you may say, a variety of grades, and that depended on the expediency as to the point at which it was best to get out at the top. There are a good many places to get out. You know it is a canyon, the easterly side of the east fork of which for some distance back from the ocean opens onto a mesa, which mesa slopes gently to the eastward, parallel to the ocean. You can see that with the eye, driving over it, without any instruments; and it was a point with us, if we built that way, whether we should not have to turn out to the westward from our existing railroad too far away from Santa Monica and build too much railroad. I can not give you anything very specific about it excepting that we decided if we did it at all, for the reasons I mention, we would use a steep grade. That would be, say about 100 feet. We could get a lighter grade, but it would land us where we didn't want to be. We abandoned that proposition, however, on different grounds than grade or cost of construction.

Mr. BURR. I suppose you expected to get out of the canyon by a cut?

Mr. HOOD. We would always make a reasonable cut coming out of a canyon, but it is quite evident that with the facilities we had, and the point to which we were already running our trains, that anything different from what we have done would cost special and independent service for the wharf to some extent, instead of the present combined service. Is that right, Mr. Muir?

Mr. MUIR. Yes, sir.

Mr. HOOD. Allow me to ask Mr. Muir, as he is the operating officer.

Mr. RODGERS. Mr. Hood, I would like to ask why it is that so many allusions are made to the present tunnel as the only approach to the beach?

Mr. HOOD. You have asked something that has been puzzling me for a long time. Those allusions can not have been made by men versed in railroad construction. I had an idea they were made by people who thought the tunnel was an obstacle, and made before committees of Congress who were not technical and who could be made to think it was an obstacle; but if any railroad engineer in the United States who has had three months and a half experience in construction will say that he thinks the construction of a tunnel of any length in that kind of material is an obstacle I would like to take a look at him at least, so that he can not get in my employ.

Mr. RODGERS. Is there any difficulty in duplicating that tunnel?

Mr. HOOD. No, sir; there is no difficulty in making an open cut. We should have built it that way originally. It is ridiculous to have a tunnel there at all. The tunnel was built practically at the request of the citizens of Santa Monica who preferred the tunnel. It was pretty close work to tunnel in there without its caving on us, but we did it. The Santa Monica people preferred this tunnel to an open cut with the highway over it; and if they still retain that preference when railroads come in there, you can put in as many tunnels as you want to. But it is nonsense to tunnel there.

Mr. RODGERS. Then there is plenty of room outside of that tunnel for other railroads?

Mr. HOOD. I would like you to indicate to me what you wish to express by the word "outside."

Mr. RODGERS. Well, to the southward.

Mr. HOOD. No, sir; there is not. There is plenty of room to the northward, and I explained perhaps not as clearly as I ought to have done yesterday because in being questioned it is difficult sometimes to say just what you want to; but I think in the written memorandum which I filed covering the point I stated it pretty clearly that there was plenty of room to the northward for tunnels and indicated what adjustment of the relative use of tracks could be made without interfering with any existing tracks. But I do not think there is room for a narrow-gauge tunnel to the southward.

The CHAIRMAN. If the Santa Monica Canyon were used to get on the beach with a railroad, about what would be the grade?

Mr. HOOD. We should have used from 100 to 116, probably 106 feet compensated. It can be verified now with a day's work with level and chain. That grade we adopted as a matter of expediency simply, but we abandoned the whole proposition for the reason I have mentioned.

The CHAIRMAN. If a road was coming in so it could come down that canyon to best advantage what would the probable grade be?

Mr. HOOD. I really can not tell you. I think possibly 80 to 100 feet, but I will decline at this late date to say unless I had a chance to refer to my reports.

The CHAIRMAN. That is only your memory?

Mr. HOOD. My remembrance is that 80 feet would not be difficult to get. Although this may be foreign to the subject, I should say that if I had money enough to build a railroad from Salt Lake to Port Los Angeles via Los Angeles, and thought it would be a good investment in the present state of development of the country (upon which I will express no opinion whatever) I should not want to come down the Santa Monica Canyon unless I knew more about the advantages of it than I do now; and for the very plain reason that although if the breakwater is constructed there, and a great many wharves, of course Santa Monica will grow, but in the present state of things of course everybody wants a little bit of all the business there is, and I should certainly want to come in and help the Southern Pacific Company carry the people to the beach, the Arcadia Hotel, the bath house, the Sunday travel, and the daily travel of people many years. If you went down the Santa Monica Canyon, unless you ran an additional spur down to the Santa Fe and Southern Pacific near the Arcadia Hotel, you would not get the business of Santa Monica.

Mr. MORISON. In your testimony yesterday you stated that it was your intention if a breakwater was built there, but not otherwise, and if the Government would consent, to fill out all along the inner harbor wherever you have control, and you have control from Santa Monica Canyon to the wharf. That was your statement yesterday. By that I understand that you have contemplated occupying and owning whatever level ground might be made by filling between the present shore line and a bulkhead line to be hereafter established.

Mr. HOOD. Yes, sir; a suitable depth. That was what we contemplated. Not to do it all at once, but from time to time, as business would require it.

Mr. MORISON. You have contemplated that, and it would be your land?

Mr. HOOD. Yes, sir; and we have made estimates simply for the purpose of giving our patrons room close to the wharf, which is not as plentiful there as I would like it to be. It is not plentiful anywhere except up the Santa Monica Canyon for anything but tracks. There is plenty of room along the beach for tracks. For business purposes Santa Monica Canyon is the only available room, but if we should make filled ground in this manner, it would be still more convenient to the railroads than any other ground existing. I made estimates of that proposition some time ago.

The CHAIRMAN. Mr. Hood, to whom would this new land, this filled space, belong; to the Southern Pacific Railroad or to the riparian owner?

Mr. HOOD. It would belong, in my opinion, which I say I express with some hesitation, to the riparian owner; and, so far as I know, for the greater part of the distance the Southern Pacific Railroad is the riparian owner; but it would require right at this minute a survey of the contour of the present high-tide line as related to a line parallel to and 50 feet from the railroad to determine which part of that distance the riparian owner was respectively the Southern Pacific or the owner of the land back of the Southern Pacific.

Mr. MORISON. There is a very intimate relation between the Southern Pacific and the riparian owner?

Mr. HOOD. There is a very cordial relation, and I have no doubt it will continue, because it ought to; but if you wish me to be exact, I will have to make a survey.

Mr. MORISON. Does the Southern Pacific own its right of way in fee or simply have an easement at this particular location?

Mr. HOOD. My remembrance is that the right of way we obtained from Jones and Baker, which is 50 feet wide, 25 feet half width, but not symmetrical with the present track (64 feet out of symmetry; in other words, the present track is one track of a future double track), is a right of way not in fee; that is, it is reversionary

in case the use of it is discontinued. My remembrance is that above there, in crossing Santa Monica Canyon, we had a right of way from two or three different owners in a short distance—little tongues of land—and my remembrance is that those were in fee, but I am not certain.

Mr. MORISON. Then the 100-foot strip—

Mr. HOOD. Of C. P. Huntington was, I think, in fee. We are taking all our right of way deeds in fee when we can, but if anybody contests it we do not make a point of it. In all these cases I hope you gentlemen will understand clearly that I do not carry the abstracts in my head. Sometimes I remember about it and sometimes I do not. But it is very easily identified, and I would like to have introduced as my testimony on this point whatever the records of Los Angeles County show.

Mr. MORISON. In other words, you are not an expert on titles?

Mr. HOOD. No, sir; and more than that, I do not profess to remember everything. I try to and sometimes I do not come out very well.

The CHAIRMAN. Is there anyone present who wishes to speak to the Board as to the merits of Santa Monica as a harbor? If so, we are ready to hear them. If not, the case of the Santa Monica people will be considered as closed.

Judge WIDNEY. With reference to that point I would like to ask this question so as not to be misunderstood. The points I wish to speak on would more fully appear after the other side has introduced its evidence, and it would be in the line of a comment affirmatively upon the evidence introduced in favor of the Santa Monica Harbor. In rebuttal is that admissible, or under your ruling would I have to make the remarks at the present time? My reason for putting it further on is this: That I should like to discuss in answer sufficient evidence that the other side could not introduce at all, either for or against one place or the other; and that I might omit to discuss evidence that they did introduce. As a practicing lawyer we always try to get our evidence in on both sides before we undertake to review the merits of the two. I do not exactly understand what the Board intend in their ruling. I want to submit myself to them entirely in that respect.

The CHAIRMAN. Your desire is to sum up the evidence?

Judge WIDNEY. Yes, sir; not to introduce any new matter.

The CHAIRMAN. The Board will hear arguments, no new matter to be introduced, but the summing up and remarks upon the evidence offered, after the testimony is all in from both sides.

Capt. JOHN CROSS. I would like to inquire if this matter is going to be open for general discussion by the citizens of Los Angeles and adjoining country, or whether it is confined to the interests of these railroad companies. If citizens are to be heard as citizens, I would like to be heard some time after the other matters are considered.

The CHAIRMAN. If you have anything to say that directly affects the merits or demerits of either one of these places as harbors, the matter that we are by law confined to, we shall be ready to hear you.

Captain CROSS. I have only a few words to say. It seems to me a question that has been antagonized and carried on by two or three railroad corporations, and the citizens have been worked up to some extent in the way of prejudice against one company or the other. I appear here, not as a friend of either railroad, no interest in either railroad, either Mr. Huntington's or the Terminal. But I do want to say to the people that it seems to me, as a citizen and business man who has had considerable experience in business, that if we were going to build a harbor to accommodate Los Angeles—and that means southern California—that Santa Monica, if it is possible to locate it there and maintain it, is for the best interests of this country.

I have lived here for ten years, have been a humble citizen, and have done some business, and most people know me. I have taken no sides with the question at issue, because I considered it a matter between two railroad corporations, and I as a citizen, as I stated before, deem it essential and to the best interests of this country that that harbor, if it can be built and maintained, should be located at Santa Monica. This Board are the ones to pass upon that and not these other citizens and myself. Santa Monica is 3 or 4 miles nearer to us as a city and as a community, and I think that is pretty well understood. There is certainly a prejudice among these people, and I want you to so understand it in considering it.

The CHAIRMAN. The advocates of San Pedro can take the floor.

Mr. JOHN F. FRANCIS. Mr. Chairman and members of the Board, with your permission I will occupy but one moment of your valuable time. The Free Harbor League was organized for the sole purpose of attempting to have located a deep-water harbor at the point which in the opinion of its members was the best and most feasible for that purpose, viz, San Pedro, and their opinions were based to a large extent upon the favorable reports of successive boards of disinterested Government engineers, and also their knowledge of the needs of the commercial and shipping world. This league has retained the services of an eminent engineer to present its case and interests before your honorable body. I believe you have met the gentleman in his official capacity as our representative. Mr. H. Hawgood will now take charge of our interests.

Mr. H. HAWGOOD. Mr. Chairman and gentlemen of the Board, I have the honor to address you on a subject of vital importance, perhaps the most vitally important to this section of the country.

At the opening of the presentation of the Santa Monica case, testimony was introduced as to the opinion of Senator Frye upon the interpretation of the act under which you act. Senator White, the author of that act has sent a telegram here, expressing his views, which I am requested to read:

"WASHINGTON, D. C., December 21, 1896.

"JOHN F. FRANCIS,

"President Free Harbor League, Los Angeles, Cal.:"

"Have been informed that Mr. Corthell, the railroad engineer, claims that he is in possession of a statement from a member of the Commerce Committee to the effect that the Board now in session in Los Angeles was so appointed as to require absolute exclusion of all consideration of inner harbor at San Pedro. Such an assumption is unwarranted, and is in harmony with the arrogant impudence which has throughout characterized that side of the controversy. The statute will govern the Commission, and the gentlemen composing it will undoubtedly follow the obvious requirements of the river and harbor bill, which demand a location of the harbor at the most desirable point. If the inner harbor constitutes element in solving the matter of eligibility, there is no law requiring the Board to exclude this important factor. The requirements of the situation imperatively necessitate the most beneficial location, and this involves the consideration of all circumstances, be they great or small. No letter from any Senator or Congressman can define or limit the duty of the Board. No dictation from any source, near or remote, can legitimately prevent the fixing of the improvement at the most suitable place. The act of Congress does not demand or permit the exclusion of those advantages which the Almighty has accorded without consultation with the Southern Pacific.

"Please send me copy of Mr. Frye's letter.

"STEPHEN M. WHITE."

The best site for a deep-water harbor is that which best combines the essentials of a harbor of commerce and a harbor of refuge. We believe that San Pedro is superior in these respects to Santa Monica.

While it is not within my province as a civil engineer to discuss the military phase, still it is a condition that is inseparable from commerce, and I may be allowed to draw attention to the report of the Board of 1892, and to the statement of General Craigbill before the Senate Committee on Commerce, in April of the current year, "That the Board was unanimous in the view that San Pedro and its inner harbor is a more worthy object of defense and is more easily defended than any harbor of refuge that could be created at Santa Monica."

This statement of General Craigbill serves to bring out the point that a true harbor of refuge must be a refuge from stress of war as well as stress of weather. The opinion of the 1892 Board on this subject, is to be found on page 16 of Executive Document No. 41, Fifty-second Congress, second session, and reads as follows:

"From a national point of view, the capacity of the harbor for defense is a matter of the highest moment, since an indefensible commercial port is simply an invitation to attack in time of war. We have now too many such ports, and it is not desirable to increase the number."

In approaching the subject of the commercial harbor, I first take the standpoint of the business men and the structures they need.

The railroads I regard not as prime factors, but in their proper and useful sphere as accessories and conveniences of trade.

The business men need a location where they can build at moderate expense and individually own sheds, warehouses, elevators, etc., immediately alongside the ships' berthings. They need a location where drays and other vehicles, drawn by horses can reach their warehouses and the ships' sides.

It would be a serious obstruction to trade to be compelled to use a railroad for every movement to and from a vessel. Suppose, for instance, a master needed some ship chandlery, a coil of rope, or stores of any kind, in a good commercial harbor he would send such supplies to his ship by wagon, and not be compelled to use a railroad. As exemplified by the long wharf, they can not find such a location at Santa Monica. This wharf and its approaches cost, according to Mr. Huntington's statement before the Senate committee, about \$1,000,000; the approaches at his valuation cost \$10,000 per mile of single track, which places the cost of the wharf itself at about \$950,000. The length of the wharf in 25 feet or more of water is 2,400 feet. Taking both sides of the wharf, there is available, or could be made available at small additional cost, 4,800 feet of deep-water berthing, which has been obtained at a cost of \$198 per linear foot, and it is merely a place where ships and railroad cars can be brought side by side without the requisite commercial facilities for handling, storing, and distributing freight.

To provide these common business necessities before enumerated, and which exist in every commercial harbor of even the smallest pretensions, the wharf would need be doubled in width at least, with consequent doubling of cost, raising the price to \$396 per linear foot of working space.

The structure is of perishable material, subject to ordinary decay and to the attacks of limnoria and teredo. It is of inflammable material, and subject to risks of fire. It is presumable that the wharf is a good exponent of the best that can be done for the money in that situation.

All these points are of vital concern to commerce, as the traffic must pay rates that will furnish the interest on cost of construction and the expenses of maintenance and renewals.

There are recent decisions of court to this effect.

In comparison with the cost of this wharf, I will submit to you the cost of a basin excavated from a tide flat and inclosed with masonry walls; permanent structures, subject neither to decay nor to destruction by insects or fire.

The Barry Docks near Cardiff, constructed in this manner, and having a depth of water of 39.7 feet at spring tides, cost about \$227 per linear foot of quays. I refer you to volume 101 of the Minutes of Proceedings of the Institute of Civil Engineers. In proof that this cost was not unusually low, I will cite the Alexandra Docks at Hull, which cost about \$140 per linear foot of quays, and where the walls were sometimes 62 feet high.

At the Portsmouth Dockyard Extension, Government work of a very substantial character, the basins carrying a depth of 40 feet of water, cost \$150 to \$185 per linear foot.

Some allowance must be made for the relative cost of work at the different sites, but after all reasonable allowance on this score has been made, there will still remain the showing that deep-water docks with permanent masonry walls can be made on the San Pedro tide flats at no greater, and probably less, outlay for construction and much less for maintenance than structures of equal working capacity of perishable material built out to deep water in Santa Monica Bay. Furthermore, it is in accord with usual commercial harbor construction to bring the deep water into the traffic rather than to carry the traffic out to deep water, the water being the most mobile. This method imposes no difficulties on vessels, while it greatly facilitates the successful solution of the multifarious questions connected with the land service.

There are 1,200 acres of tide flats at San Pedro available for the purpose. As a suggestive comparison, it may be stated that the entire water area in the docks of Liverpool and Birkenhead is about one-half of this, viz, 545 acres.

The next point of commercial superiority of San Pedro is the low railroad grades between that point and Los Angeles. Comparing the Southern Pacific lines from San Pedro and Santa Monica, from San Pedro to Los Angeles, the heaviest grade is on Alameda street, within the city limits. For 400 feet it is about 34 feet per mile. This distance is too short to constitute the ruling grade, which is about 30 feet per mile. In climbing off the beach at Santa Monica, the maximum grade from the north portal of the tunnel to the top of the hill near the water tank, a distance of about 1 mile, is 158 feet per mile; but this also is for a short distance, the ruling grade being about 100 feet to the mile. In evidence of these facts I file with you a profile from surveys made on the 17th instant, marked "Free Harbor League Exhibit No. 1."

The effect of these heavy grades on the Santa Monica line is to more than annihilate the advantage which appears to attach to that place in point of distance, leaving the balance in favor of San Pedro. The same weight of engines can move more freight from San Pedro than from Santa Monica, and that is the point which concerns commerce, not the mere mentioned distances upon which stress has been laid.

Mr. MORGAN. Mr. Hawgood, have you equated the grades and curves on the two lines?

Mr. HAWGOOD. No, sir; I have not.

Mr. MORGAN. Then, it is merely your opinion that you give in regard to this?

Mr. HAWGOOD. I know that there is more curvature on the Santa Monica line.

Mr. MORGAN. But you give your opinion, although you have not made a scientific computation?

Mr. HAWGOOD. No, sir; I have not. We have thought that unnecessary; but I have seen the same weight of engine bringing up heavier loads from San Pedro than from Santa Monica.

If the deep-water commercial harbor be made in the San Pedro Flats, its accessibility to railroads is too obvious to need comment. If, on the other hand, it should be decided to carry the traffic out to deep water in an outer harbor at San Pedro, the accessibility to roads, although materially decreased, would still be less restricted than at Santa Monica. Should the plan for an outer harbor necessitate east-side roads passing to the west side, they can readily do so by turning the head of the

lagoon at Wilmington and avoid bridging. With reference to Santa Monica, I file with you a map and accompanying photographs, marked Exhibit No. 2, giving the line of high water taken by photographic survey of the morning tide of October 8 last. The map also gives other information on the subject of room for railroads, showing that little exists above high-water line outside the Southern Pacific right of way.

Coming to the marine side of a good commercial harbor, one of the first needs is facility for the installation of establishments to conduct rapidly and efficiently the repairs so constantly needed by shipping.

The San Pedro Flats afford every facility for these purposes. At Santa Monica no such facilities exist, nor can they be created with any practicable outlay.

I would like to point out here that if docks are built out from the shore, dry docks or others, there must be a channel for the admission of vessels, which would have to be dredged out through the sand, and this channel would be constantly filling up from the littoral currents.

This point alone places Santa Monica in an inferior position. It would rank as a port of call, and could not be considered a harbor in its fullest sense or a suitable terminal point for oceanic lines.

To the mail steamers, rapid and efficient repairs are of the greatest importance. Repairs are chiefly connected with painting, damage to rudder, rudder post, propeller, or stem, all necessitating dry docking, for which Santa Monica presents no facilities whatever.

In connection with the possibilities of San Pedro as affected by draft of vessels plying on the Pacific Coast, I submit the following extract from a publication by the commission of the port of Portland, Oreg., regarding the deep-draft vessels laden with flour and grain, cleared from that port for points beyond Cape Horn, from September 1, 1894, to September 1, 1895:

Total number of full-rigged ships and barks.....	105
Total registered tonnage.....	tons.. 32,878
Maximum register of any one vessel.....	do... 2,570
Minimum register of any one vessel.....	do... 707
Mean register of all vessels.....	do... 1,733
Maximum draft.....	23 feet 5 inches
Mean draft.....	21 feet 3 inches
Minimum draft.....	17 feet

	Number.	Per cent of total number.
Vessels of 23 to 23 feet 5 inches draft.....	3	2.8
Vessels of 22 to 23 feet draft.....	18	17.1
Vessels of 21 to 22 feet draft.....	57	54.3
Vessels of 20 to 21 feet draft.....	22	21
Vessels under 20 feet draft.....	5	4.8
Total	105	100

Twenty-five feet at low water is the ultimate depth of channel contemplated by the port of Portland.

No port with that depth need lack for vessels to carry cargoes in or out.

Observations of the wind have been kept at the custom-houses at San Pedro and Santa Monica for the past six months. The original records I will file with you. In brief, these records show 91 per cent of the winds at Santa Monica to be within the semicircle from east to west, the prevalent wind being southwest. The site proposed for a breakwater at Santa Monica is open to all the winds that blow from the west end of the Ballona Flats around to the high land back from Point Dume, an arc which extends from east-southeast around to west. The land between Ballona and Redondo is too low to be of any material shelter to the proposed breakwater site, and San Pedro Hill is too far off, 18 miles, and lies too nearly "end on" to be an effective wind-break.

The San Pedro records show 96 per cent of the winds to be in the semicircle from east to west, with the prevalent wind southwest. Both at Santa Monica and San Pedro there are generally light easterly airs in the morning, which toward noon change to moderate westerly breezes.

San Pedro is sheltered by high land on the west from north around to south, and is thus fully protected from the prevailing winds. It is open to the southeast storms, which are of rare occurrence. These storms, while strong in comparison with the usual winds of this locality, would be considered small affairs on the Atlantic Coast.

The evidence of the light-house keeper at Point Firmin as to the rarity and strength of the southeast storms would be particularly pertinent. As bearing on this point, I have examined the files for the past thirteen months of the Pilot Charts for the North Pacific Ocean, published by the Bureau of Navigation of the Navy. The chart for December, 1895, gives a probability of southeast winds for six days in the month, with a force of 5. This was for longitude $122^{\circ} 30'$, about 240 miles west of the coast. The chart for November, 1896, gives a probability of southeast winds close inshore for three days in the month, with a force of 2. None of the other charts gives any southeast winds. As the information of the Navigation Bureau is collected with infinite pains and published for the especial purpose of guiding and warning mariners, its bearing upon this point is of particular weight and importance.

To man's evidence I will add the silent testimony of the trees that grow on the coast. They have no bias save all their lives to turn from the wind that does most fiercely assail.

Sailing vessels from foreign ports arrive between the islands of Santa Rosa and San Nicolas. From there Santa Monica has an advantage in point of distance of 5 or 6 miles, which is a matter of little moment in a long voyage.

With outbound vessels San Pedro has the weather gauge of Santa Monica. Testimony will be introduced to the fact that the least towing is done at San Pedro. The approach to San Pedro is freer from danger than Santa Monica, on account of less fog. I file with you Exhibit No. 3, being fog and wind records kept at the custom-houses at San Pedro and Santa Monica since last June. This period covers the fog months as given on the Pilot Charts before referred to.

Total number of days compared, 154.

Fog at San Pedro on 22 days, 14.3 per cent of 154.

Fog at Santa Monica on 36 days, 23.4 per cent of 154.

Minimum duration of fog, 2 hours at San Pedro, $1\frac{1}{2}$ hours at Santa Monica.

Maximum duration of fog, 9 $\frac{1}{2}$ hours at San Pedro, 15 hours at Santa Monica.

Mean duration of fog, 5 hours 27 minutes at San Pedro, 6 hours 9 minutes at Santa Monica.

Total fog at San Pedro, 120 hours.

Total fog at Santa Monica, 221 $\frac{1}{2}$ hours.

The ratio of fog at San Pedro to fog at Santa Monica being as 100 to 184.6.

The cost of blowing out of the water the rock over which the bell buoy rides at San Pedro could probably be taken care of within the appropriation of \$2,900,000.

The excellent quality of the holding ground at San Pedro has been admitted. I desire, however, to draw attention to the point that in a harbor vessels generally moor, the protected area being usually too valuable to allow vessels to swing at their anchors.

The advocates of Santa Monica have given an important place to the slope of the sea bottom in front of their proposed breakwater. The true application of the theory depends upon a knowledge of the depth at which the waves at the location under consideration begin to be affected by the bottom. Without actual measurements of the characteristics of the waves, it is not possible to do more than approximate what this depth may be.

Assuming as a possible thing the waves to be 12 feet high, with a proportionate length of 225 feet, and applying the generally accepted trochoidal theory of deep-sea waves, such a wave could not feel the bottom at a greater depth than 30 fathoms. I notice from Mr. Corthell's profile that the bottom slope at the two places is essentially the same between these limits.

While it is only possible to surmise as to the effect the bottom may have on the waves, we have facts as to the effect of the waves on the bottom, as shown by the bottom itself. I ask your attention to the level assumed by mud at both places, and refer to the paper on "Tides and Coast Works," by the eminent harbor engineer, Thomas Stevenson, read before the Institute of Civil Engineers in April, 1885. In this paper Mr. Stevenson says there is "a feature which will be found of very considerable value in judging of the exposure of a coast. This is the level below the surface of low water at which mud reposes on the bottom. Though at first sight it might appear unlikely that the disturbance of the sea level by wind waves would be propagated to great depths, there are numerous facts which prove the contrary. Although the absence of mud in any locality proves nothing, because the tide currents may sweep it away or the geological formation may not produce it, yet its presence seems both a delicate and certain test of the lowest limit to which the disturbance originating at the surface has reached. Thus as the waves progressively decrease in magnitude in the North Sea between Shetland and the coast of the Continent the level of repose of mud progressively rises nearer the surface from a depth of 80 or 90 fathoms to only 8 fathoms at the mouth of the Elbe and to 12 fathoms off the coast of Holland, where ships can take the open beach in nearly all weathers without any protective harbors. If, therefore, we find in front of a proposed harbor or coast work that mud reposes within a few fathoms of the surface, I believe we have

in that fact certain ground for concluding that our works will never be assailed by a very heavy sea."

Gentlemen, the charts show the mud in front of San Pedro Harbor, close to the breakwater site of 1892, to lie in 8 fathoms of water. According to the high authority quoted, this is proof of no heavy seas.

I ask your attention to the small size of the rock forming the jetties at San Pedro as being good additional evidence on this subject.

In a paper advocating San Pedro, read by me in 1895 before the Engineers and Architects' Association of Southern California, I expressed the opinion that the breakwater, as designed by the Board of 1892, would intercept the shore currents and cause shoaling. This opinion was based upon the statement of the Board that at the southern end of Santa Monica Bay a well-marked current ran to the north and west and the observation that the groin north of Deadmans Island had accumulated sand on its north face. It is true that on the other hand there was evidence that material from San Pedro washed ashore at Long Beach; still the preponderance of evidence in my possession at that time favored the assumption that the sand moved north, and I drew my conclusions accordingly. During the last four months it has come to my notice that the sand on the north face of the before-mentioned groin was disappearing, together with the beach in front of the single work at the north end of Rattlesnake Island, and that the sand on the south face of the groin was apparently increasing. This was the opposite of what would occur with a north and west sand movement, and set me to thinking that it would be better to see what the sand actually did than draw conclusions from a current that after all might have nothing to do with the movement. Accordingly, I commenced a study of the beach itself, with the following results:

Commencing at the long wharf at Santa Monica, there are indications that sand is accumulating on the west side of its junction with the shore.

At Ballona, a sand spit has worked down from the west, pushing the outlet of the stream eastward until further movement has been stopped by the bluff.

The bar at the entrance to the inner harbor at San Pedro hooks round to the east. The early work of the Coast Survey plotted on a scale of 1 in 10,000 shows that prior to any harbor improvements the sand spits near Deadmans Island pointed to the east.

The outlet of the Los Angeles River has been pushed toward Long Beach by the growth of the western spit, until the Terminal Railway Company has had to resort to diking to arrest further movement.

The outlet of the San Gabriel River at Alamitos Bay has been pushed eastward until further movement has been arrested by clay banks.

At Anaheim Landing the first impression is that the sand dunes have grown from the south. Examination shows that the outlet channel is in clay and has not sensibly changed since the surveys of 1875. It is possible that the same clay underlies the sand dunes, which are high compared with those nearer Long Beach, and are the effect of wind. The western sands at the outlet of the creek hook to the south and east. The same remarks apply to Bolsa Creek.

At Newport, the Santa Ana River has been pushed southward down the coast for nearly 8 miles.

At False Bay, north of San Diego, the stream has been pushed southerly until the bluffs have stopped further movement in that direction. Coronado Beach, under the lee of Point Loma, seems a parallel to Rattlesnake Island under Point Firmin.

With these realities before me, I can no longer believe in a movement to the north and west or in any conclusions based on that theory.

Referring again to my paper, some quotations have been made from it on the subject of railroads on the west side of San Pedro, but as the statements quoted have special reference to a particular design of breakwater, they are immaterial to the selection of the best harbor site, however pertinent they might be to the selection of the best breakwater.

The method of computing protected areas by projecting, in the direction of the swell, a line past each end of a breakwater is very misleading, unless it is always borne in mind that this area does not by any means represent still water. The waves swing around the ends of a breakwater, through quite an appreciable angle, without any sensible diminution of height or force.

Mr. MORGAN. Excuse me for interrupting you. You say they would swing around to a very considerable angle. Now, that may be of importance. Can you specify to some extent what angle?

Mr. HAWGOOD. I would say that from the direction of the swell, as shown here from this area and passing this end—

Mr. MORGAN. What I mean is, what would the departure be from the direct line of the swell?

Mr. HAWGOOD. Well, they will swing around until they even run along the inside of the breakwater. They do that at the Plymouth Breakwater, and I have had experience there with very lumpy water from waves rounding the breakwater.

Mr. MORGAN. Suppose within 5,000 feet, we will say, of the breakwater, what would the departure be, do you think?

Mr. HAWGOOD. Certainly 45 degrees, probably more. And even after they have spread and reduced very materially, they still cause a lumpy water that would render it uncomfortable for vessels lying at a wharf. This is particularly so where the waves from the two ends meet, and is an objectionable feature of detached breakwaters. I desire to indorse Major Raymond's opinion expressed before the Senate committee, "that river and harbor engineers generally would consider a breakwater parallel to a rectilinear shore in the manner proposed, to be defective," and like him, I do not know of a harbor so constructed. I do not find among the thirty-three breakwater cases submitted by Mr. Corthell a single instance that is a parallel case to the Santa Monica proposition. The plans will speak for themselves whether I am right or wrong.

Take Cherbourg, for instance; there is nothing whatever in common between that plan and the proposed shelter at Santa Monica, except the detached breakwater. Cherbourg Harbor consists of an outer harbor of refuge, a naval station, and a commercial inner harbor and docks, an arrangement for which San Pedro is most admirably adapted.

Take Plymouth as another instance, a harbor with which I am familiar. The breakwater stretches nearly across a bay between headlands, a superior proposition to Santa Monica, and I know that you sometimes get a very lumpy sea behind that breakwater, from the waves that whip around the ends, and I desire to draw your attention to the secondary breakwater built off from Mount Batten, to protect Plymouth against these waves.

In regard to Mr. Corthell's reference to Harcourt's work on Harbors and Docks, a work which you undoubtedly have, commencing on page 80, the one referred to, I will ask you to read all that chapter. It is entitled, "Peculiar types of harbors with detached breakwaters." All these peculiar types have end protection; the Santa Monica proposition has none, except the hills to the west.

In point of "fetch," seas from south-southeast have a clear sweep between San Pedro and Catalina to the site of the proposed harbor at Santa Monica. They would flank the breakwater and most seriously disturb the area between it and the shore, and the "racers" that have been so graphically described would rush along the breakwater face.

More could be said in support of the superiority of San Pedro and its admirable fitness for a completely protected front harbor for refuge and naval purposes, with a deep-water harbor behind, well adapted to the necessities and convenience of commerce, and unrestricted as to ingress, egress, or future development, but I think it unnecessary to occupy much more of your time, and will conclude with some remarks upon the question of harbor of refuge.

A harbor of refuge is a shelter from one of three things, or from a combination of them:

First. A refuge to seek repairs from damage by storm or accident; second, a refuge from stress of weather; third, a refuge from stress of war.

The last phase I have already commented upon. As to the first, Santa Monica can be no refuge, as there can be no docks at that location. As to the third, and to all three cases, safety of approach is the one thing essential above all others.

San Pedro is at a salient point, and lies under the lee of high land. Santa Monica is deeply embayed and forms a lee shore to the prevailing winds.

The approach to a salient point is safer in storm than the entering of a bay. On this subject, I quote Thomas Stevenson, whose argument is both clear and forcible. He says:

"The true situation for a harbor of refuge is rather upon a salient than upon an embayed part of the line of coast, because first, a salient part of the coast will lie nearer to the line of the general passing trade than a reentrant part; and second, vessels seeking a haven, and failing to make it, will not find themselves embayed, but be still well to windward, and have sea room to bear away for a more distant haven on either hand. There is indeed a sense in which a harbor of refuge in the bottom of a bight may be regarded as a source of danger instead of a source of safety. Cardigan Bay in Wales, for example, is just such a place as might perhaps be selected. But though a harbor in Cardigan Bay might in exceptional cases do good, it would be dearly purchased if the presence of the harbor tempted masters to leave a track of safety and unnecessarily to embay themselves. It will, I think, be generally admitted that if from fog a vessel failed to pick up the position of the harbor in the bay, there would be hardly a chance of her escaping shipwreck. A harbor of refuge on this principle is either kill or cure, for it offers one chance to the distressed vessel, which she must seek at the cost of embayment, but a harbor of refuge on a salient part of the coast offers a chance of shelter without necessarily compromising the safety of the ship in case she fails to make it."

I have not taken up the subject of plans or methods of construction, because I understand it to be your wish to first decide the question of location upon general merit, but should it be desired to enter upon questions of construction, I shall be glad to prepare the necessary documents showing that the San Pedro site can be brought within the limits of the appropriation, and fulfill the conditions of a deep-water commercial harbor and a harbor of refuge.

The CHAIRMAN. Do you wish to convey the idea that a breakwater at Port Los Angeles would be of little or no benefit to ships at the wharf?

Mr. HAWGOOD. In my opinion, it would be of some benefit, and be better than no breakwater at all.

Mr. RODGERS. The argument which you read last, in regard to a breakwater without embayment, would seem to indicate that it should be open at both ends?

Mr. HAWGOOD. No; that argument refers to the adoption of any locality for a harbor of refuge which is embayed.

Mr. RODGERS. Then, I understand it, it should be open at either end for the course of a vessel in case of a storm, or in case she wants to go out?

Mr. HAWGOOD. Yes, sir.

Mr. RODGERS. Would that be so at San Pedro? From the plans which are before us, a vessel could not go out at either end of that breakwater.

Mr. HAWGOOD. The plans submitted by the Board of 1892 join onto the land, and there is but one way in and one way out.

Mr. RODGERS. Is not that an embayment?

Mr. HAWGOOD. To a small extent it is, but that is not an embayment of 12 miles, such as exists at Santa Monica.

The CHAIRMAN. You were speaking of the geographical position?

Mr. HAWGOOD. Yes, sir; not of the detail of construction.

Mr. BURR. Do I understand you to contemplate, in your view of a harbor of refuge and for commerce at San Pedro, that the outer harbor would be for anchorage only and the inner harbor would be designed for actual commercial purposes?

Mr. HAWGOOD. That would be my view of it; that the outer harbor would constitute a harbor of refuge, a place for naval vessels, and a port of call; and that the commercial harbor would be dredged out of the land.

Mr. BURR. I noticed that Mr. Hood spoke of building out from the shore.

Mr. HAWGOOD. I believe it would be easier to take the water in to the land than to take the land out in the water. It appears to be necessary to do one of the two.

Mr. BURR. You did not contemplate, then, the construction of any piers into the outer harbor, as contemplated at San Pedro?

Mr. HAWGOOD. It could be done.

Mr. BURR. You will not contemplate that in your consideration of the question?

Mr. HAWGOOD. In the consideration of the question from my standpoint, I would make the outer harbor and the inner harbor separate—that is, one for refuge and the other one for commerce.

Mr. BURR. Then in this estimate of \$2,900,000, of which you have just spoken, would it cover the requisite deepening of the inner harbor as well as the construction of an outer breakwater?

Mr. HAWGOOD. Yes, sir; I believe it would cover enough for all the needs of to-day and for some years to come.

Mr. BURR. You cited some estimates of the cost of English harbor work. Have you any data which would guide you in determining the relative or the actual cost of similar work at San Pedro?

Mr. HAWGOOD. By the general knowledge I have of the cost of work here I can prepare and submit to you those comparisons. They will be taken from my general knowledge of the cost of work here and the cost of work in England.

Mr. BURR. My only object in asking that question was to ascertain whether you had made estimates of the cost of similar work based upon the cost of labor, material, and appliances on the Pacific Coast?

Mr. HAWGOOD. I have not made definite estimates; I speak as a matter of my opinion, without making close estimates.

Mr. BURR. In considering the deepening of the inner harbor at Wilmington or at San Pedro, what depth of channel at the entrance have you taken?

Mr. HAWGOOD. I contemplated 25 feet at the inner part.

Mr. BURR. What depth did you contemplate at the entrance of the channel at Deadmans Island?

Mr. HAWGOOD. That was 25 feet at low water.

Mr. BURR. Do you consider 25 feet as a sufficient depth for a deep-water harbor for commerce and for refuge?

Mr. HAWGOOD. On the figures that I have submitted they found it to be sufficient at Portland, Oreg., which is a deep-water harbor of the Pacific Coast. I think it is sufficient. And further, if there were an outer basin—which there would be—any vessel drawing somewhat more than that could easily lighter a little before she went in.

Mr. BURR. Then, if vessels which now call at Port Los Angeles drawing 27 feet should call at San Pedro you contemplate lightering a part of her cargo?

Mr. HAWGOOD. It does not preclude the building out of piers in the harbor. That is all open to the building of piers. It would depend entirely upon what plan was adopted—in what manner and to what points the piers would be built out. I presume piers would be built by individuals, and they would have the selection of the places.

The CHAIRMAN. There are now running large marine ships drawing 30 feet and upward; what would you do with one of those ships if she came to San Pedro?

Mr. HAWGOOD. She would work in the outer harbor. I believe the tendency now is to shallower draft ships—that is ships of commerce that ply in all the ports of the world.

Mr. RODGERS. If you were to build wharves, or assuming that wharves were to be built at San Pedro, where should they be built; in the inner or outer harbor?

Mr. HAWGOOD. Probably in both places; but I would prefer mine on the inner harbor. They could do it easier and carry the water in easier than to carry the land out.

Mr. RODGERS. But you could not carry ships of 27 feet draft in a 25-foot harbor?

Mr. HAWGOOD. Perhaps the provision would be enough to make more than that. I simply contemplated 25 feet. I have not made a deeper estimate.

Mr. RODGERS. I wanted to get at your idea of the proper location for wharves in the outer harbor at San Pedro.

Mr. HAWGOOD. I would want to know, before I could answer that, what plans about the harbor would be used. Whether it would be an inclosed harbor or whether it would be a breakwater projecting from the cape, as proposed in 1892.

Mr. RODGERS. Well, the only plan proposed has been a breakwater projecting from Point Firmin.

Mr. HAWGOOD. As I understand it the act leaves with your Board the preparation of plans.

Mr. RODGERS. But I wanted to ask your opinion. You are familiar with the locality, and I wanted to know your idea of the location.

Mr. HAWGOOD. If the breakwater is built as designed, there is but one shore that you can build your wharves from—the land under Point Firmin.

Mr. RODGERS. The Point Firmin shore?

Mr. HAWGOOD. The western shore.

The CHAIRMAN. If you had your choice, from what point on that shore would you run your wharf out?

Mr. HAWGOOD. With the breakwater built as proposed by the Board of 1892?

The CHAIRMAN. Yes, sir.

Mr. HAWGOOD. I would want to come up as far as I could to about the position of the Southern Pacific Company's railroad.

The CHAIRMAN. Why would you not just as soon run your wharf out to the ocean closer to town?

Mr. HAWGOOD. The closer I got to town the more exposure I get.

Mr. MORISON. Supposing that no breakwater were located and that you had the determination of the location of an outside wharf, and with the breakwater which we have projected, that being virtually the situation which has been brought up at Port Los Angeles, where would you put that outside wharf?

Mr. HAWGOOD. I don't quite understand you.

Mr. MORISON. Assuming that no breakwater has been determined; that you were considering plans to build an outside wharf, with the understanding that you built a breakwater to protect it; where would you put the wharf?

Mr. HAWGOOD. I should put it under the lee shore (Point Firmin). Always supposing it is a breakwater of the form proposed by the 1892 Board.

Mr. MORISON. The wharf is to be built and the breakwater built afterwards, and you are to determine where you would put the wharf, with the supposition that the breakwater could be arranged to suit the wharf. Where would you put the wharf in that case?

Mr. HAWGOOD. In that case I would use all that beach and put breakwaters from Point Firmin and Deadmans Island, and then they would all be protected.

Mr. MORISON. Where would your wharf be?

Mr. HAWGOOD. My wharf would be from any point alongshore where I could reach out to deep water.

Mr. MORISON. It would be from the shore between the present channel and Point Firmin. You would not go east of the channel?

Mr. HAWGOOD. If there was a breakwater built out from Deadmans Island, I might utilize it for that purpose.

Mr. MORISON. You don't seem to get my question. I do not suppose any breakwater could be built until after your wharf is built. I suppose the breakwater is

put where it will protect your wharf. Where would you build your wharf independent of any breakwater?

Mr. HAWGOOD. I should build it from some point on that shore.

Mr. MORISON. West of the entrance?

Mr. HAWGOOD. West of the entrance; yes, sir.

Mr. RODGERS. You would not go down to Rattlesnake Island, outside of the present entrance, or east of Deadmans Island?

Mr. HAWGOOD. I would have to build a long way out there to get to deep water. I would look to the point where I could get to deep water the quickest.

Mr. MORISON. You would not go there where you would have to build so long a wharf?

Mr. HAWGOOD. No, sir; I don't think I would.

The CHAIRMAN. Your plan contemplates excavating a harbor in Wilmington Lagoon, and making sufficient depth of entrance to it to take large ships in, and then protecting that entrance, as I understand it, by an outside breakwater which would form an outer harbor and a protection to the entrance of the inner harbor?

Mr. HAWGOOD. Yes, sir.

The CHAIRMAN. Am I right in that?

Mr. HAWGOOD. Yes, sir.

The CHAIRMAN. If you have a ship drawing 25 feet come there, or have a deep-draft ship or one of the heaviest modern ships and you had 25 feet at low water, how deep a ship could you carry in?

Mr. HAWGOOD. With an ordinary tide of about 4 feet there that would give me 29 feet, and if it was quiet water protected by the breakwater, I suppose a foot and a half under the keel would be sufficient.

The CHAIRMAN. That would make you 27½ feet?

Mr. HAWGOOD. Yes, sir. Possibly a wharf, if constructed inside, could be dredged deeper, and then it would be a tide harbor and you would have to wait the tide to get in.

The CHAIRMAN. What prevents your deepening that entrance to the inner harbor more than 25 feet?

Mr. HAWGOOD. Nothing whatever, only simply the amount of money.

The CHAIRMAN. There is rock in the neighborhood of Deadmans Island in the channel.

Mr. HAWGOOD. We will introduce the contractor who dredged in that locality, and who will give you better testimony than I can. I can only tell you what he has told me.

The CHAIRMAN. So far as you know, after you get into this inner harbor how far do you go down into the mud before you strike anything hard? Do you know, or have you made borings?

Mr. HAWGOOD. No. I will refer you to the contractor on that.

Mr. BURR. In regard to the movement of sand, to which you have given some attention, have you made any close observations, or have you any information in regard to sand passing either one way or the other along the beach to Rattlesnake Island?

Mr. HAWGOOD. No, sir; I have made no close observations myself. I studied the movement of the sand, believing that its moving was by wave action and not by current at all. The wave movement is the chief moving factor.

Mr. BURR. You think that the easterly and southerly movement of the sand is due to wave action?

Mr. HAWGOOD. To wave action on the shore. The prevailing winds are from the west and southwest, and although the waves as they arrive at the shore line themselves up nearly to the line of the shore, yet they come in at an oblique angle to it, as the photographs will show. They come up at a slight angle, so that there is a component in an easterly direction.

Mr. BURR. Do you know whether there is any movement of the sand by the winds along this beach or coast?

Mr. HAWGOOD. From the looks of the sand dunes, which are comparatively high at Anaheim Landing and at Bolsas Creek, there must be a wind movement there, and I have seen the sand blowing a little at San Pedro under a westerly wind.

Mr. BURR. That movement will carry the sand to the westward, then?

Mr. HAWGOOD. No; it will go with the prevailing wind. It would go to the eastward.

Mr. BURR. The charts show that a considerable shoal has formed to the eastward of Deadmans Island, and has accumulated to some extent against the jetties. How do you account for that if the prevailing movement is to the eastward?

Mr. HAWGOOD. I think that an inspection of the ground—(What was the date of that chart?)—an inspection of the ground to-day will show that it is eating away; that it is going away from the junction and from the single work at Rattlesnake Island, and the single work is in danger to-day of undermining. As to the shoaling occurring to the eastward of Deadmans Island, the contractor of whom I spoke will tell you a good deal as to the shoaling he made there by dumping.

Mr. BURR. The charts to which I make reference are those which have been corrected up to 1896. They show a large area of shoal water immediately eastward of Rattlesnake Island and that portion of the bay. Large mounds of sand are formed in there by some means or other. Apparently it has been piled up and increased. We have no chart far enough back to establish that point, but what I would like to ask is how you would account for the formation of that shoal in there if the prevailing movement of the sand is to the eastward?

Mr. HAWGOOD. I can not quite understand the presence of that shoal. I would like to ask if it was ascertained from soundings made in this area in 1896? The beach is actually disappearing, and I don't see how there can be a shoal here when the beach here is going.

Mr. BURR. But the chart shows it.

Mr. HAWGOOD. Were those soundings made in 1896?

Mr. BURR. The soundings were not made in 1896, but the chart has been corrected up to 1896. I don't know whether those individual soundings were corrected up to that time or not. Then again, just to the westward of the entrance at Deadmans Island, on the westerly side of the west jetty, there is also a sand formation along there—a shoal. Have you any idea as to its origin or method of formation?

Mr. HAWGOOD. It would be easily explained by an easterly current coming around Point Firmin and setting against the west jetty, and if you will look at the bar which is formed there, which I presume is built up by the swell from the west, it is built on the west side of the entrance and curves round to the east.

Mr. BURR. Where does the material come from?

Mr. HAWGOOD. It may come outside from Santa Monica Bay or may come from other points.

Mr. BURR. Being carried around by the currents?

Mr. HAWGOOD. Carried around.

Mr. BURR. Isn't that rather a long carriage?

Mr. HAWGOOD. Rather a long distance, but there is sand on the beach all the way around.

Mr. BURR. It is a pretty rocky shore, isn't it?

Mr. HAWGOOD. Right here it is rocky. It might come from the seecaw of the tide up and down.

Mr. BURR. It is your impression that the ocean movement of the sand is easterly all along that shore?

Mr. HAWGOOD. Based on an observation of the character of the sand spits, they go to the east.

The CHAIRMAN. Supposing your theory to be right, and the breakwater was built as laid out on that wharf, where would your sand going from the eastward lodge, then, after passing the end of the breakwater?

Mr. HAWGOOD. It would land eastward of Rattlesnake Island along the beach.

The CHAIRMAN. Don't you think it would be likely to work inshore there a good deal toward the mouth of the harbor?

Mr. HAWGOOD. I think that the water setting out from the lagoon would keep that out.

The CHAIRMAN. But it runs in half the time, doesn't it?

Mr. HAWGOOD. As I understand it, the sand is not in suspension. I think the depth of the water here is 10 fathoms, and presumably below that depth there is no sand movement.

The CHAIRMAN. Can you tell me the draft or how deep a vessel you can take into San Pedro now?

Mr. HAWGOOD. Eighteen feet, I believe.

The CHAIRMAN. That is at high water?

Mr. HAWGOOD. We will introduce the pilot of the port, who will give you definite information on that point.

The CHAIRMAN. Do you know what the depth of the entrance is at low water at the present time?

Mr. HAWGOOD. Fourteen feet, I believe.

Mr. BURR. What depth of water have you contemplated back of the breakwater for entrance purposes?

Mr. HAWGOOD. The breakwater is out in about 9 or 10 fathoms—between 8 and 10 fathoms—gradually shoaling as it comes in to shore.

Mr. BURR. You make reference to that particular breakwater shown there. Is that the one you have contemplated in considering the outer harbor?

Mr. HAWGOOD. The one I contemplated was slightly within that.

Mr. MORGAN. Mr. Hawgood, you made a former presentation of the question of a harbor to your society here—I think the engineers and architects of southern California—and of course you predicated that upon a careful study and having before you the action of the Government engineers in their reports?

Mr. HAWGOOD. Yes, sir.

Mr. MORGAN. Have you at any time made a practical test as to the bottom of the sea within the area occupied by the harbors, proposed either by the engineers or by yourself, to determine whether it is ledge rock or detached rock that underlies mainly that portion of the sea at that point?

Mr. HAWGOOD. I have not made those investigations.

Mr. MORGAN. Then you are unable to state in respect to that?

Mr. HAWGOOD. I can not state in respect to that.

Mr. MORGAN. The general principles which governed you in establishing a breakwater adversely to the views entertained by the Government engineers remain, I suppose, with you?

Mr. HAWGOOD. No. One principle—

Mr. MORGAN. I understand. You modify your views in respect to the action of the littoral currents?

Mr. HAWGOOD. Yes, sir.

Mr. MORGAN. But in other respects, do you still maintain the same views that you expressed at that time?

Mr. HAWGOOD. Yes, sir; I believe I do as applying to that.

Mr. MORGAN. The main or general principles which governed you in establishing the breakwater you still maintain?

Mr. HAWGOOD. Yes, sir.

Mr. BURR. I asked you a question a moment ago in regard to the depth for anchorage which you had contemplated in the projected area inside of the breakwater, and I understood you to state that you had contemplated a breakwater a little inside of this one.

Mr. HAWGOOD. Yes, sir. I believe, if you will permit me to interrupt you, the map which was made for the engineers' association shows the relative positions.

Mr. BURR. I would like to ask what you consider as the minimum depth available for anchorage purposes inside of your breakwater for heavy ships?

Mr. HAWGOOD. About 25 feet.

Mr. BURR. Four fathoms only, or about that?

Mr. HAWGOOD. About that.

Mr. BURR. What would you do with heavy ships drawing from 25 to 30 feet?

Mr. HAWGOOD. They could lie closer to the breakwater in deeper water.

Mr. MORISON. How much depth would you use to anchor a 30-foot ship behind the breakwater?

Mr. HAWGOOD. I think I should want to give her 5 feet under her keel.

Mr. BURR. Where she cast her anchor how deep water would you want?

Mr. HAWGOOD. About 8 fathoms to cast anchor.

Mr. BURR. I don't mean the length of the anchor cable, but how deep would you want to have the water where the anchor was dropped?

Mr. HAWGOOD. About 8 fathoms. I contemplated that largely the occupation of the outer harbor would be at moorings. Ships would pick up moorings, rather than anchor.

Mr. BURR. As a matter of fact, for heavy ships you would have to have a depth of from 6 to 8 fathoms. Now, a reference to the chart will show that there is an extremely small area inside of the breakwater, as shown, which will give you that depth, and if you place your breakwater a little inside of that shown, that available area will be still more reduced.

Mr. HAWGOOD. Yes, sir.

Mr. BURR. Will not that correspondingly reduce the extent and value of the harbor?

Mr. HAWGOOD. In the paper referred to the harbor's area is given, but the outer harbor would be used chiefly for refuge, as there would be no ships practically lying there except at times in stress of weather.

Mr. BURR. Then the greater part of your protected area within the breakwater is of shoaler depth and consequently not available for refuge for the heavier ships for which a port of refuge should be designed. How would you treat that aspect of the question?

Mr. HAWGOOD. That I think the area provided is enough.

Mr. BURR. You think the small area between the 6 and 8 fathom contours is sufficient behind that breakwater as shown?

Mr. HAWGOOD. I should think so.

Mr. BURR. It is very small.

Mr. HAWGOOD. I think it is 235 acres outside of the 4½ fathoms.

Mr. BURR. What do you count as the easterly limit of that 235 acres? Will you please, with the pointer on the map, designate the line of the easterly limit? Place your pointer from the outer end of the breakwater as shown on the map and along the easterly limit of this 235 acres for anchorage.

Mr. HAWGOOD (showing line on map). That is where the 4½-fathom line crosses the breakwater, and it runs in this direction [showing toward Rattlesnake Island], and from there on it is deeper than 4½ fathoms.

Mr. BURR. If the swell swings around the end of your breakwater to the limit of, say, 45 degrees, it seems to me that a considerable portion of the area of refuge will be rendered practically valueless.

Mr. HAWGOOD. With this design of breakwater—the design of 1892—I think so.

Mr. JOHN A. FRANCIS. We have a gentleman here from Salt Lake who desires to be heard for a few moments before the adjournment, as it is absolutely necessary for him to leave on the afternoon train. We desire to introduce Mr. Charles O. Whittemore, a gentleman from Salt Lake City, representing the Chamber of Commerce of that city, who desires to be heard on the commercial features in this matter.

The Hon. CHARLES O. WHITTEMORE, of Salt Lake, Utah, then addressed the Board as follows:

Mr. Chairman and gentlemen of the Commission, the people of Utah, who have conferred upon me the honor of representing them before this Commission, feel that they have an interest in the location of the proposed deep-water harbor second only to that of the people of southern California. There are two aspects of this question, both of which will doubtless receive full consideration by this Board. One is the maritime situation; the other, equally as important, is the commercial situation. Utah's interests are to be regarded from the commercial standpoint, and I shall therefore confine myself to that branch of the discussion.

When the citizens of Salt Lake were advised of this hearing, a meeting of the Chamber of Commerce was held to take some action in the matter, and as a result a set of resolutions were adopted, which I now take pleasure in presenting to you.

The speaker then read the resolution, as follows:

"SALT LAKE CITY, December 18, 1896.

"Admiral JOHN G. WALKER, U. S. N.,

"Chairman of Commission to Locate Deep-Water Harbor,

"Los Angeles, Cal.:

"The Salt Lake Chamber of Commerce, at a meeting held this day, unanimously resolved to present to your Commission, on behalf of said city and the State of Utah, the fact that this State is deeply interested in the proper location of the proposed deep-water harbor for southern California, for the reason that our citizens are engaged in an effort to build a line of railroad to connect this city with Los Angeles and the proposed harbor. This railroad, when completed, will be a through transcontinental line, and will be the shortest line between the Atlantic and Pacific oceans. In southern Utah along the proposed line, and not more than 500 miles from tide water, occur vast deposits of iron ore, fully equal in extent and quality to the great iron ranges of Michigan. Contiguous to these great iron deposits there exist coal measures of almost unlimited extent. Considering the scarcity of coal and iron on the Pacific Coast, and contemplating the future growth and development of the trade and commerce of that region, and of South America, Australasia, and the Orient, we deem it of the utmost importance that a suitable harbor be secured near Los Angeles, by which these invaluable products of our State may reach this great and growing market. The arrangements are well advanced to commence the construction of this railroad.

"We expect to cooperate in the building of this line with the Los Angeles Terminal Company, and we are fully convinced that the construction of the road will be materially advanced, and in fact rendered certain, by the location of this deep-water harbor at San Pedro.

"The chamber is so earnest that no mistake be made in the location of the site most advantageous to this State that it has appointed the Hon. Charles O. Whittemore to appear before your Commission and present these resolutions and to personally urge the many advantages which we think will accrue to Utah, Nevada, California, and the nation by the selection of San Pedro as the deep-water harbor for southern California.

"SALT LAKE CHAMBER OF COMMERCE,

"By W. A. NELSON, President.

"Attest:

"EDWARD F. COLBORN, Secretary."

Not only do these resolutions express the sentiments of the Salt Lake Chamber of Commerce, but they voice the unanimous opinion of the people of the entire State.

We agree with the second proposition laid down by the gentleman who addressed you in favor of Santa Monica, Mr. Corthell, that this is a question which not only affects California, but affects the adjoining States and the nation at large.

There is a fundamental principle of law, as well as of political economy, that in the expenditure of public funds it is the duty of the servants of the people in whom the trust is imposed to so use the fund as to insure the greatest good to the greatest number. If, therefore, this Commission can, by the selection of San Pedro as a site for a deep-water harbor, benefit the whole people of southern California, and of

Nevada and Utah as well, while by selecting Santa Monica enhance the interests practically of one corporation, then all else being equal, its duty is plain in the premises and will no doubt be performed. When I say that the selection of San Pedro as a deep-water harbor will benefit the whole people of southern California, Utah, and Nevada, while the selection of Santa Monica will only inure to the advantage of a single corporation, I speak advisedly, and propose to demonstrate the correctness of my statement. This contest is a battle being waged by the people on one side for San Pedro as against the Southern Pacific corporation for Santa Monica on the other. This must have become apparent already to the members of this Commission by the fact that no one except the agents, employees, and servants of the Southern Pacific have either by word or act espoused the cause of Santa Monica, while on the other hand it will be demonstrated to you as the hearing progresses that the people, not only of southern California, but of the trans-Mississippi country are advocating the cause of San Pedro.

In connection with the resolutions of the chamber of commerce, and to further establish that statement, I desire to call your attention to resolutions which were adopted at the Trans-Mississippi Congress held at St. Louis in 1894. This was a congress, as you are possibly advised, containing representatives from twenty-six States and Territories lying west of the Mississippi River. It was a representative body, called together to consider the vast interests of that great region, and here are the results:

"ST. LOUIS, November 28, 1894.

"The Trans-Mississippi Congress has passed the following preamble and resolution:

"Whereas, upon the completion of the Nicaragua Canal, a deep-sea harbor on the southern coast of California is indispensable to the commercial and naval necessities of the country, there being no adequate harbor facilities between San Diego and San Francisco, a distance of 600 miles of sea coast; and

"Whereas the United States Government, through its corps of army engineers, has, by its several boards in exhaustive reports, unanimously selected San Pedro harbor as the most eligible site for such deep-sea harbor, and the only practicable harbor of refuge between points Dume and Capistrano, as required by act of Congress; and

"Whereas there is an interior harbor at San Pedro which has been improved by the Government under the direction of its engineering corps, and which has a dock frontage of more than two miles in extent: Therefore, be it

"Resolved, By this Trans-Mississippi Congress, that the Congress of the United States, at its coming session, be urged to provide for the construction of this deep-sea harbor at San Pedro, as already determined by the several acts of Congress and in accordance with the several recommendations of the Boards of United States Army Engineers, as shown by Executive Documents Nos. 39 and 41 of the Fifty-second Congress, first and second sessions; and that the further improvement of the interior harbor at San Pedro be earnestly recommended."

Why this condition exists it is not difficult to explain. San Pedro as a harbor offers facilities for trade and commerce that Santa Monica does not possess. With San Pedro as a harbor the people generally can enter into commercial relations with Central and South America and the Orient without being at the mercy of a corporation as soulless and as grasping as any that was ever known to exist.

We predict the future conduct of an individual by what he has done in the past, and in the same way the people of southern California, Nevada, and Utah know what the course of the Southern Pacific will be if it gets this appropriation for a harbor at Santa Monica just as well as they know the manner in which the people have been dealt with in every case where the Southern Pacific has held the vantage ground. It would be a monopoly in the fullest sense of that word. It is true that the law of Congress authorizing this expenditure provides that if the Board reports in favor of Santa Monica the Southern Pacific is required to enter into an agreement so that any railroad company may share equally with the Southern Pacific Company the use of the pier now constructed on the site of said harbor, and the approaches thereto situated westerly of the easterly entrance to the Santa Monica Tunnel, upon its paying a proportionate cost of that part of the pier used by such railroad company and its proportionate expense of maintenance of the particular part of the pier and approaches so used. But it is needless for me to remind the members of the Board who, as engineers, have had experience in railway construction and management, that in the rivalry always existing between competing railway lines such restrictions and conditions can be imposed upon the company whose interests are subordinate as to render such a franchise valueless and make that part of the law nugatory.

Utah is interested in the selection of this harbor because the people of that State are engaged in an effort to build a line of railway between Salt Lake City and Los Angeles which, when completed, will form part of a transcontinental system and be the shortest line between the Atlantic and Pacific oceans. Such a line would

become one of the great arteries of trade and commerce in the United States, and in connection with a proper harbor it would be the means of extending that trade to South America and the Eastern Empire. Such a trade will in the course of time become enormous in its proportions and harbor facilities of the most extensive character will be an absolute necessity. If a place is selected that will not meet these requirements, then the purpose of this appropriation of public funds will fail. If a site like Santa Monica is selected for this harbor, which can never become anything more than a port of entry and discharge, then, instead of being one of the world leading commercial ports, the harbor would remain practically what it is now—a place where coastwise and tramp steamers could take on and discharge their cargoes, provided the wind was not too strong and the waves were not running too high. For the trade and commerce that this port would have if properly located there should be unlimited opportunity for the building of extensive warehouses, wharves, and docks, and with as little expense as possible, so that the merchant and tradesman of limited means would have an equal opportunity with the corporation backed by its millions. It should be a place where warehouse and wharfage privilege could be obtained without paying charges such as would have to be exacted to return a reasonable percentage on the vast sums that would have to be invested at Santa Monica to afford any commercial advantages whatever. These charges would be practically prohibitory in so far as the smaller merchants are concerned, and especially would this be true with regard to the shipping of bulky products handled on close margin, such as coal, iron, lead, copper, sulphur, soda, salt, asphaltum, etc.

Utah is interested in the location of this harbor for the further reason that along the proposed railway line, and not more than 500 miles from tide water, occur large deposits of iron ore. These ore bodies are so vast in extent and so pure in quality as to excite the wonder and admiration of the leading geologists of our country. Professor Newberry, in a report that I will file with your secretary, says of them:

"The deposits of iron ore near Cedar City, in southwestern Utah, are probably not excelled in intrinsic value by any in the world. There are certainly no other deposits to compare with them west of the Mississippi for the manufacture of pig and bar iron and steel, and it would be difficult to estimate the influence they will eventually have on the industries of the Pacific Coast."

Prof. W. P. Blake, in a report, says: "Utah's iron resources must exceed those of any other section of the Union."

The United States Baldwin Exploring Expedition reports:

"Utah's greatest wealth lies not in its hundreds of gold and silver ledges, but in its iron and coal fields. The seemingly fabulous stories of the immense iron deposits in southern Utah but told part of the truth. The district is one vast extent of rich magnetic and hematitic ores. The ledges crop out of the earth in places hundreds of feet high, and appear on the surface for 800 or 1,000 feet. But a few miles distant are immense bodies of coal with which to melt out this huge body of material wealth."

Japan, one of the coming commercial and industrial nations of the world, is to-day in search of just such iron as exists in southwestern Utah to meet the demands of her rapidly increasing manufactories. To engage in this branch of trade with Japan and the South American countries, the people of Utah must have a port where warehouse and wharfage facilities are extensive and where the products of iron can be handled with the smallest expense possible.

Utah's interest in the proposed harbor arises also from the fact that there exist coal measures of almost unlimited extent within her borders. With opportunities for export, such, for instance, as will arise on the completion of the Salt Lake and Los Angeles Railway and the establishing of a deep-water harbor in connection with it, the coal trade that will follow will be something enormous. With a coal area of not less than 5,000 square miles, there will be absolutely no limit to the capacity for production. When it is realized that there are no coal mines between Utah and the Pacific Coast, and that we are able to supply the entire California demand as well as that of other countries where coal is required, you will appreciate our interest in having a harbor selected that will make this vast business enterprise a possibility.

In addition to iron and coal, and equally valuable, are our great bodies of asphaltum and hydrocarbons. These deposits cover an area of about 13,000 square miles and contain sufficient asphaltum and enough of the hydrocarbons, elaterite, gilsonite, and ozocerite to supply the world for centuries to come. The refined asphaltum produced in these fields is superior to any other form of asphaltum produced in the world. Its analysis is 99 per cent pure, while the Trinidad asphaltum is a coarse article as compared with it, being only 30 per cent pure. All the largest varnish makers in the United States now use this Utah asphaltum for the manufacture of the highest grades of black japan and asphaltum varnishes. All black japanned tin for signs, etc., are prepared with it, and gilsonite is used for street paving and in a refined state for all fine black-varnish work, to the exclusion of all other kinds. These products will, therefore, form a valuable adjunct to our foreign commerce and will need cheap

and extensive harbor facilities. Excellent sulphur mines also exist in several parts of the State. In Millard County, near the proposed railway line, the deposits of sulphur are far richer and more abundant than in Sicily. The present production is 50 tons of pure sulphur per day. This output will be much greater when better facilities for export are obtained. Plaster of paris is being extensively manufactured from the deposits of gypsum, and already large quantities have been shipped to California.

Salt to the amount of 100,000 tons per annum is gathered along the shores of Great Salt Lake and shipped to various parts of the United States, where it is used for milling and manufacturing purposes. Its uses will be extended as we build up a foreign trade.

Utah wants an opportunity to distribute throughout the world the mineral wealth that nature has supplied her with. She can only do this through a port such as is hoped this Commission will establish. We do not come to champion the cause of one railroad company as against another nor to take part in any local contention. Our mission is to promote the trade relations with foreign countries. We do not want to be placed at the mercy of the Southern Pacific Company or any other corporation. We do, however, want a harbor that will afford the people of our State an opportunity to enter into free and unlimited commercial relations with trans-Pacific countries. We are fully convinced that San Pedro as a harbor will meet all these requirements, but that Santa Monica will afford us nothing.

The hearing was then adjourned until December 24, 1896, at 10 a. m.

FOURTH DAY.

DECEMBER 24, 1896.

The Board reconvened at 10 a. m., pursuant to adjournment, all members being present.

Mr. HAWGOOD. Mr. Chairman and gentlemen of the Board, I would like to make some further statements in answer to Professor Burr's questions regarding sand.

I have compared the chart of 1896 with that of 1886, and with the exception of the bar at the mouth I find the hydrography to be the same. I have compared the chart of 1896 with the chart of 1855, and find there is a slight increase of depth between Deadmans Island and Point Firmin. I would like permission to prepare a comparison of the charts of 1852, 1855, 1859, 1875, 1883, 1886, and the last one of 1896. As it will have to be done by pantographic work, I can not possibly get it finished before you close your hearing. I would like permission to file it with you as soon as completed.

The CHAIRMAN. You may file it at any time.

Mr. HAWGOOD. Continuing the comparison with the 1855 chart, before the improvements between Rattlesnake Island and Deadmans Island were made, there were channels between Deadmans Island and Rattlesnake Island sometimes, and sometimes between Deadmans Island and Point Firmin. After the breakwater was constructed between Rattlesnake Island and Deadmans Island a scour took place to the westward of Deadmans Island, and the sand that was scoured was probably carried eastward, and would, in a measure if not entirely, account for any filling up. And continuing the same subject of the sand, I find by referring to the tide tables of the Coast Survey that it is high tide at San Pedro and at Point Hueneme, beyond Point Dume, at the same time. It is high tide at Santa Monica Bay two minutes later, so that the tides approach there in both directions; in the direction from San Pedro to Santa Monica the current would probably be the slightest, as it would be against the prevailing winds. In the other approach the tide would come in with the prevailing wind. The ebb tide takes the same direction. Between Santa Monica and San Pedro it would run out with the wind, and would be stronger than the portion going out against the prevailing wind to the westward; so that the stronger force would be acting to the eastward, moving the sand with it. The same reasoning applies to San Pedro and Long Beach. It is high tide at Long Beach after San Pedro, and high tide at Anaheim Landing after Long Beach, and high tide at Newport Landing after Anaheim; and the tide movement in that direction would have the wind to help it, and in the opposite direction the wind would be opposed to it. I wish to advance that as a probable reason, or one of the reasons, for the sand moving eastward.

I desire to correct, if such misapprehension exists with reference to the profile which I introduced yesterday, showing grade from Santa Monica beach to top of the hill. I gave it exactly as it was found and reported to me. It shows for a short distance—a hundred feet—a steep grade. I wish it to be distinctly understood, and I think it due Mr. Hood that I should say so, that I do not consider that that short piece of grade has a material effect. It is a hundred-foot grade, and it is practically operative as such.

I would like to continue my statement as to the building out of wharves from this shore, by asking you at your convenience to compare the distances from this shore to

deep water as compared with Port Los Angeles. San Pedro is somewhat the shorter distance. The wharves could be constructed to deep water at less expense.

There was a question put to me yesterday which I do not know that I fully comprehended—I believe Professor Burr asked it—in the manner of the swells sweeping around the end of that breakwater and decreasing the anchorage. I understood the question to refer to the breakwater as proposed by the 1892 Board. Was I right, sir?

Mr. BURR. That is practically correct. I understood you at the time, however, as commencing by first advocating a breakwater of the same character, but a little inside of this landing.

Mr. HAWGOOD. No; the one inside, sir, I would take in conjunction with the one put out from Deadmans Island, making an entrance.

Mr. BURR. Oh, yes.

Mr. HAWGOOD. That is all, gentlemen. If there are any questions—

Mr. MORISON. Mr. Hawgood, you stated that you thought the expense of excavating a harbor at San Pedro or excavating an interior basin would be less than the expense of building piers at Santa Monica. I think that is your statement?

Mr. HAWGOOD. Yes, sir.

Mr. MORISON. Have you made a detailed estimate and plans for such an arrangement?

Mr. HAWGOOD. No, sir; but I would be very happy to furnish you with such a statement. Permit me to say that I did not know until a week ago that I would appear here before you. I simply give that as my opinion.

Mr. MORGAN. Mr. Hawgood, there was considerable said here yesterday in respect to the littoral current, its movements, and its acting as a carrier for material, making a deposit at those different places; and in your statement in respect to the change of opinion you said that you had made a more critical examination of the subject than originally. I would like to ask if in making that critical examination you considered the sources from which material was brought to the ocean?

Mr. HAWGOOD. No, sir; I did not.

Mr. MORGAN. At the Wilmington Harbor?

Mr. HAWGOOD. No, sir.

Mr. MORGAN. Do you know what proportion of Los Angeles County is drained into the Wilmington Harbor and in its vicinity by the Los Angeles River and in the vicinity by the other rivers? Do you know what proportion of the county?

Mr. HAWGOOD. I could not say that without examining the maps.

Mr. MORGAN. You are aware, probably, that most of the area lying west of the divide—the mountain divide—drains into San Pedro Bay; and the Los Angeles River, I notice by the relief map of this county which is in the adjoining room, the Los Angeles River takes its rise west of Santa Monica back of the mountains and is carried around into San Pedro Bay, so that the principal drainage of this county is into San Pedro Bay—that is, the drainage that comes to the ocean.

Mr. HAWGOOD. I am not prepared to admit that, sir.

Mr. MORGAN. I do not say positively as to that. I only take it from my observation of this relief map. My purpose in asking the question is to get as much information as possible in regard to material that may be carried down by these rivers during violent freshets. I did not know but you might have considered that while you were considering the subject you speak of.

Mr. HAWGOOD. I did not, sir, because my investigations were conclusive to me in my own mind that any material discharged here would go eastward. The flow of the river into the Wilmington Harbor is not as complete as this map would perhaps indicate. There are communications, but they could be readily diked off. The ground itself is the best evidence.

Mr. MORGAN. I do not of course assume to know what the results may have been, but there is a natural action of forces which must have a result somewhere, and I was seeking to get information.

Mr. HAWGOOD. There will be testimony introduced, sir, that dredging done in the interior harbor is permanent and that it does not fill up.

The CHAIRMAN. Mr. Hawgood, what do you think about the case of the deepest channel to the outer end of the jetties—the deep channel at least to the eastward, near the east jetty?

Mr. HAWGOOD. I attribute that to the wave action—the heavy swell—the prevailing swell around Point Firmin from the westward.

The CHAIRMAN. Does the prevailing wind in summer have any tendency to move sand dunes down the coast and thus move the mouths of the creeks down the coast?

Mr. HAWGOOD. That I could not answer from personal observation.

The CHAIRMAN. Do you know whether the mouths of these rivers have a tendency to work down the coast?

Mr. HAWGOOD. The wind here at the mouth of the Los Angeles River would have a tendency to move down the coast probably. At Anaheim Landing and below, the bay swinging around, I would rather think that the wind would almost be inclined

to move it inland or a little in this direction. The indications would point that way, but I have no personal knowledge of the actions of the wind during the summer months.

Mr. FRANCIS. Mr. Chairman, the next gentleman will be Mr. John A. Hooper, of San Francisco.

Mr. HOOPER. Mr. Chairman and gentlemen, I have been requested to present to you this petition, which, with your permission, I would like to read:

"SAN FRANCISCO, November 28, 1896.

"To the Board of Harbor Commissioners for Locating a Harbor at San Pedro or Santa Monica, on the Coast of Southern California:

"DEAR SIRS: The undersigned will respectfully represent that they are residents of the city of San Francisco and extensively interested in the commerce of the Pacific Coast, being owners of vessels engaged in coastwise commerce between the ports of that coast; that from their observation and experience they are strongly impressed with the superiority of San Pedro as a location for the proposed harbor for the accommodation of the commerce of the city of Los Angeles and southern California for the following reasons, among others:

"First: That there is now at San Pedro a completely landlocked harbor which will accommodate vessels of 18 feet draft, and a moderate expenditure upon said harbor of the character heretofore recommended by the Government officials in charge will improve it sufficiently to accommodate vessels of 25 feet draft, which draft is as great as any now engaged or likely to be engaged in the commerce of this coast for some time in the future.

"Second. That the construction of the proposed breakwater at Santa Monica can never produce a harbor in the commercial sense of the term for the reason that there is no possibility of securing interior docks or basins at that place; that the area protected by the proposed breakwater of sufficient depth to accommodate vessels of considerable size will be very circumscribed, and most important of all, the cost of extending wharves from the shore to a depth of water which will accommodate vessels of considerable draft is so enormous, being, according to the estimates of the Southern Pacific of the cost of its wharf at that place, something like one-half million dollars, that the proposed harbor at that point would in no sense be open to general competition and its benefits would necessarily be confined to large and wealthy corporations or companies who could build the expensive wharves demanded by the conditions at that place.

"Wherefore, the undersigned would respectfully request that the harbor proposed for southern California be located and constructed at San Pedro.

"F. P. & J. A. Hooper, lumber and shipping; Byxbee & Clark, lumber and shipping; S. H. Harmon & Co., by S. H. Harmon, president, lumber and shipping; J. R. Hanify, lumber and shipping; Gray & Mitchell, lumber and shipping; F. Heywood, lumber and shipping; Renton, Holney & Co., lumber and shipping; Preston & McKinnon, lumber and shipping; Charles F. Doe & Co., lumber and shipping; C. A. Hooper & Co., lumber and shipping; E. B. Dean & Co., lumber and shipping; G. S. Hinsdale, shipping; Gardina Mill Co., lumber and shipping; James Tibb, shipowner; Pope & Talbot, lumber and shipping, 204 California street, San Francisco; Hanson & Co., lumber and shipping, 48 Market street, San Francisco; J. G. Jackson, lumber and shipping, 48 Market street, San Francisco; Dolbeen & Carson, lumber and shipping; Robert Dolbeen, lumber and shipping; Albion Hunter Co., by Miles Shubert, lumber and shipping, 3 California street; L. E. Slade Lumber Co., lumber and shipping, 3 California street, San Francisco; Samuel Blair, lumber and shipping, 3 California street, San Francisco; Higgins & Collins, lumber and shipping, 22 Market street, San Francisco."

I should like to add that from a personal acquaintance with all the signers of this petition I am safe in saying that it represents the ownership of 75 per cent of all the sailing business owned in California.

The CHAIRMAN. Mr. Hooper, what is the draft of the vessels engaged in that trade to San Pedro—about the average draft?

Mr. HOOPER. They run all the way from 13 to 18 feet.

The CHAIRMAN. You take in 18 feet there now at high water?

Mr. HOOPER. Yes, sir.

The CHAIRMAN. You speak about 25 feet in addition. That would be 7 feet more, but the engineer's estimate is 4 feet more on an expenditure of \$392,000, isn't it?

Mr. HOOPER. I think so.

The CHAIRMAN. That would take in about 22 feet?

Mr. HOOPER. Yes, sir.

Mr. MORISON. What draft would you use if you could, if you had an indefinite depth at San Pedro; what draft vessels would you want to use, considering where the vessels come from, etc.?

Mr. HOOPER. Well, I think the tendency now of building, as far as I can find out, vessels of largest draft, largest ones about 23 feet; sometimes 24. I think they have quit building 26, 27, and 28 feet draft vessels to a great extent. I think 22 feet of water would accommodate the great bulk of the shipping world at present being constructed.

Mr. MORISON. What class or draft of vessels would you prefer to use for the class of business which you are doing, which I understand is very largely lumber business?

Mr. HOOPER. In that business we would not use any larger than we have now—18 feet draft. If we had 26 feet of water on the bar to-day we would not, if we were going to build, build anything to draw over 18 or 18½ feet anyhow.

Mr. MORISON. What fixes that limit?

Mr. HOOPER. Well, that is about as large as we would care to build for the lumber trade. A vessel drawing 18½ feet would carry a million feet of lumber. Of course, we might increase that if the business was very large, but in very few instances they are built for the lumber trade to carry over 800,000 or 900,000 at present, and these vessels we can get in now to the docks without any trouble.

Mr. MORISON. In the lumber business you unload from your vessels to the wharf?

Mr. HOOPER. Take them right up to the wharf; yes, sir.

Mr. MORISON. And how much room do you require for that lumber business?

Mr. HOOPER. We own about 14 acres, and we occupy probably about 11 or 12; 11 I should say for a guess. That is not exact; may be 10 would be nearer right. Some of it is hardly available.

The CHAIRMAN. How is the draft of your vessels affected by the northern lumber ports and their bars?

Mr. HOOPER. Well, it has a certain effect in this way, that there are quite a number of places on the California coast at which we load by cargoes where they haven't as much water as we have at San Pedro. That business, though, is principally done through steam schooners that draw 12½ to 14 feet of water.

The CHAIRMAN. Then, as I understand it, the draft of water for your vessels would be limited, not only by San Pedro, but by northern ports?

Mr. HOOPER. To some extent. Humboldt Bay, which is a large shipper, formerly used a great deal less water than now. We have a great deal of constructive works there now, and there is plenty of water on that bar.

The CHAIRMAN. What do you know about the bottom of the inner harbor at San Pedro, as to its being hard or soft?

Mr. HOOPER. It seems to be very hard. All I know about it personally is that we had a little dredging done at this point where we were looking about, where Bosky Slough comes in at the upper end of our wharf, some eight years ago, using a dredger belonging to the Southern Pacific—they call it the clam-shell dredger, I think—and it would not take hold, and we had to use giant powder to start it.

The CHAIRMAN. Was that a hard bottom?

Mr. HOOPER. Sand, cemented shells, etc.; everything mixed up. It was all right after we got the shell covering off the top.

Mr. MORISON. Covering on top that you had to break through?

Mr. HOOPER. It seemed to be very hard, packed, as if—

Mr. MORISON. How thick was it?

Mr. HOOPER. I could not say. I happened to be there at the time they commenced work, but I don't know how thick it was. I know they could not bring up anything with the dredger until they had used a lot of giant powder.

Mr. MORISON. When they got through the crust did it go all right below?

Mr. HOOPER. Yes; then they said they could rip it up from underneath.

The CHAIRMAN. Did you strike any rock?

Mr. HOOPER. Not at all; all sand and shells.

Mr. MORISON. You were working with the clam-shell dredge?

Mr. HOOPER. Yes, sir.

Mr. MORISON. Did you ever work with a different dredge?

Mr. HOOPER. No, sir; that is the only dredging we have ever done there.

The CHAIRMAN. From your personal experience as a business man, what are your reasons for preferring San Pedro?

Mr. HOOPER. My reasons for preferring San Pedro Harbor to Santa Monica are on the ground that I do not believe Santa Monica can ever be made a commercial harbor.

The CHAIRMAN. And why?

Mr. HOOPER. Well, from its location; no facilities for the accommodation of vessels after they get inside in case of repairs wanting to go on the dock. Everything has to be done from a track. I do not think that in my opinion it could be made what I consider a commercial harbor.

The CHAIRMAN. Do you know the sentiment of the shipowners and shipmasters in San Francisco with reference to the two proposed locations?

Mr. HOOPER. I do of a good many.

The CHAIRMAN. And they are—

Mr. HOOPER. They are unanimous—

The CHAIRMAN. In favor of San Pedro?

Mr. HOOPER. Yes, sir.

The CHAIRMAN. Was the result of your dredging permanent? Has it filled any since?

Mr. HOOPER. At this point?

The CHAIRMAN. Yes, sir.

Mr. HOOPER. Personally, I do not know; only my man in charge of the wharf one year ago made a statement that he had made—well, it may be longer ago; may be two years ago—made the statement to me one time when I was down there that he had sounded along there and there was no change at all.

Mr. RODGERS. What was the object of your dredging?

Mr. HOOPER. Merely to get the uniform depth at the wharf; about 14 feet at low water. Seemed to be a little hump at the upper end; wanted to take that off.

Mr. MORISON. If you were handling the same class of business which you now handle at San Pedro at a place like Port Los Angeles, and you would have to handle it on a pier, how would you do it?

Mr. HOOPER. I simply could not do it; I should have to transfer everything. Do you mean the wharf at Santa Monica as now constructed?

Mr. MORISON. No; how would you construct a wharf to do your business?

Mr. HOOPER. I would have to construct a wharf that would hold 8,000,000 or 10,000,000 feet of lumber or more, extend it out, and take the room there. I could not do the business if I had the whole Santa Monica Wharf to-day that I could on a lot placed at San Pedro. It would be impossible to do the kind of business I am doing.

Mr. MORISON. Do you ship anything by water from San Pedro?

Mr. HOOPER. Everything by rail from San Pedro.

Mr. MORISON. That is, you receive it at San Pedro by water and ship by rail?

Mr. HOOPER. Yes, sir.

Mr. MORISON. You receive nothing by rail and ship by water?

Mr. HOOPER. No, sir.

Mr. MORISON. If you were handling that business at Port Los Angeles, you could establish your yard in the interior somewhere and run everything into your yard by cars from the wharf?

Mr. HOOPER. Yes, sir; the same as from San Pedro into Los Angeles. That would not be the kind of business that we are doing. In other words, it would not be an economical way of doing business.

Mr. MORISON. How much would it increase the cost per 1,000 feet?

Mr. HOOPER. A dollar to a dollar and a half.

Mr. MORISON. How much do you handle in a year?

Mr. HOOPER. Well, it is varied. All the way from 18,000,000 to 60,000,000.

Mr. MORISON. Sixty millions would increase the cost from \$60,000 to \$90,000 a year? You retail your lumber from your yards at San Pedro?

Mr. HOOPER. We make that the distributing point; retailing and principally jobbing.

Mr. MORISON. What portion of the lumber that you ship from there goes to Los Angeles to be unloaded there and what portion to other points; just in a rough way?

Mr. HOOPER. I can ask a gentleman here who will give you a better idea than I can. I would not like to say.

Mr. MORISON. I suppose you could find a point for a yard nearer Los Angeles, where there would be no second loading of the portion of your lumber consumed in Los Angeles, so that you would save your extra handling on that portion of your business?

Mr. HOOPER. It is done both ways; and some think they can and some think they can not. I am rather of the opinion that the proper distributing point is right at the ship. Lumber sometimes comes to Los Angeles and sometimes goes back again; goes over the road twice. You save that; that is, it goes back to towns between here and the coast.

Mr. MORISON. You assort lumber as you receive it?

Mr. HOOPER. Yes, sir; assort it when we receive it—

Mr. MORISON. And pick it out when you want to ship it?

Mr. MORGAN. If I desired to establish a business at Wilmington or San Pedro like your own, making that the point of distribution, it would require, as I understand you, a considerable area of ground to carry on such a business. How would I manage to do that? How could I acquire that and prepare it for carrying on the business?

Mr. HOOPER. I suppose it could be acquired by purchase there the same as the other properties.

Mr. MORGAN. Yes, sir; I suppose that would be true. Well, it would then require improvements and dockage similar to that which I understand to be on your property?

Mr. HOOPER. Yes, sir.

Mr. MORGAN. So that in establishing a business there de novo, I would be obliged to make expenditures in the preparation of the ground, the area occupied, the dockage facilities, and the draft of water; all these things would have to be done, I suppose?

Mr. HOOPER. Yes, sir.

The CHAIRMAN. How would the necessity of loading immediately onto the cars affect the cost of sorting?

Mr. HOOPER. I don't know as I exactly understand that question.

The CHAIRMAN. As I understand this question, if you were at a place like Port Los Angeles, where you had to take your lumber out of your vessel and load it onto the cars at once, would that increase the cost of sorting the lumber?

Mr. HOOPER. It is hardly practicable to assort lumber on the pier when it has to be loaded direct onto the cars. It can be done, if there is plenty of room on the pier, with a little more expense.

The CHAIRMAN. Would it materially increase the expense, or would that expense be small?

Mr. HOOPER. It would be small. It would depend something on the circumstances.

The CHAIRMAN. If all facilities for lumber yards and mills were provided at Port Los Angeles, how would you then regard that port for a new firm owning nothing at either point now?

Mr. HOOPER. I can not see where facilities can be made at Santa Monica?

The CHAIRMAN. This is supposing that they are. If all facilities for lumber yards and mills were provided at Port Los Angeles, how would you then regard that port for a new firm owning nothing at either point at present?

Mr. HOOPER. I should have my preference for San Pedro. I might change my mind after I saw the improvements.

The CHAIRMAN. Mr. Hooper, how would the cost of securing a lumber yard and wharf compare with the cost of constructing a wharf for business at Port Los Angeles?

Mr. HOOPER. Well, that is a pretty hard question to answer. I would have to make considerable of an estimate as to what the cost would be at Santa Monica before I could answer that. I should say, though, that there would be a great deal more expense at Santa Monica. So many times more that it would not pay to do it.

Mr. MORISON. Mr. Hooper, your land at San Pedro is protected by a timber bulkhead, is it not?

Mr. HOOPER. No, sir; the bulkhead is away from the action of the water, a little bulkhead. It is all on piles; that is, the frontage is on piles.

Mr. MORISON. How often do you have to renew that pile work?

Mr. HOOPER. We have made repairs twice since 1881. Only once in a material way, always looking after it and keeping it up. Do not misunderstand me. Only a very short portion of our property is on piles. It is only the frontage of a width of 150 feet, say, at one end and running to 180, or about that, to the other; and the balance is all on solid land.

Mr. MORISON. Your pile work you have had to repair twice?

Mr. HOOPER. Yes; once we made quite a job of it, and other times it has been more in the nature of repairs. In fact we went right through it at one time and repaired it from one end to the other.

Mr. MORISON. Rebuilt the whole thing?

Mr. HOOPER. Rebuilt it where it was needed.

Mr. MORISON. Does your timber bulkhead that holds your filling prove permanent?

Mr. HOOPER. Oh, yes; away from the action of the water. It is a little bulkhead, put in there merely to protect the switch.

The CHAIRMAN. What do you consider the life of a pile at your place?

Mr. HOOPER. If not protected at all in any way, a pile will stand there from four to six years at the outside. We have the limnoria only on that side. I believe the teredo has not touched any of our work as I understand it.

The CHAIRMAN. From four to six years?

Mr. HOOPER. Six years would be extreme; perhaps four to five years would be nearer.

The CHAIRMAN. When you say "on that side" what do you mean?

Mr. HOOPER. I understand that on the Rattlesnake Island side there have been a few piles attacked by teredo, but we have not seen them. The limnoria are very plentiful.

The CHAIRMAN. Do you think it would cost any more to build a wharf for our business at Port Los Angeles than it would in the outer harbor at San Pedro?

Mr. HOOPER. No; I don't know as it would. That would depend something on the length of the wharf to be constructed. That I do not profess to know anything

about, but generally speaking, outside of the length of the wharf, I should not think there would be any difference.

Mr. RODGERS. As to the cost of sorting lumber, could it not be so loaded so as to know what you were coming to and arranged beforehand in the ship?

Mr. HOOPER. No, sir; it can not be done, because if lumber is put even at the mills at loading port, when it comes out it is all mixed up again.

Mr. RODGERS. Could it not be so loaded as not to be mixed up?

Mr. HOOPER. The skippers won't do it that way. We have tried it a good many times and it don't work.

The CHAIRMAN. It is more or less mixed in stowing on board ship?

Mr. HOOPER. Stowing and then breaking it out again.

The CHAIRMAN. Do you understand that there is a rock in the channel leading into the inner harbor that interferes with the deepening of the channel?

Mr. HOOPER. No, sir.

Mr. FRANCIS. Mr. Chairman, the next witness that we desire to present is a gentleman who has been in command of vessels on this coast for forty years, Captain Polhamus.

Captain POLHAMUS. I want to qualify Mr. Francis's remarks. Reduce that forty to thirty-six years.

The CHAIRMAN. You have been in command of vessels on this coast?

Captain POLHAMUS. Not in command of vessels at times, but on the water front.

The CHAIRMAN. You have commanded vessels at various times?

Captain POLHAMUS. Tugs, and acted as a pilot in my profession.

The CHAIRMAN. At what point, Captain?

Captain POLHAMUS. At San Pedro and Wilmington.

The CHAIRMAN. Have you had any experience at Port Los Angeles?

Captain POLHAMUS. Yes, sir; up along that shore from Point Dume down to San Juan, I am pretty familiar with the coast.

The CHAIRMAN. What do you think would be the effect of that projected breakwater at San Pedro as marked on the chart, that curved breakwater?

Captain POLHAMUS. It would be, I think, a success, but that map is a little misleading to me.

The CHAIRMAN. In what respect, Captain?

Captain POLHAMUS. Looking at that map, the easterly wind coming from this direction [showing] would blow in there from the ocean, which is not the fact. San Pedro is protected from every point east of southeast. I will refer you to the county map or the Coast Survey map. That map is cut right off in there where the trend of the coast line is east. The coast swings around again to San Juan, and any wind coming from the eastward of southeast does not effect San Pedro.

The CHAIRMAN. That map is like the other laid down on its side. That is the only point, but the right-hand side of it is cut off. That is, it does not show down the coast.

Captain POLHAMUS. It does not show down the coast. This Coast Survey map extending it there makes a vast difference on the action of the waves.

The CHAIRMAN. Captain, will you describe a southeaster on this part of the coast, how it begins and how it acts?

Captain POLHAMUS. A southeaster begins ordinarily with a wind from the southeast. From the southeast about that point there [showing], along the coast line. Then there isn't much swell. The ordinary set of the current is that way, so even with a southeast wind the set of the swell is a little more to the southward than what the wind is, because the swell is down. So there is where the swell will be more. It remains there a little while and then swings around in this course, increasing in intensity until it gets to the south and southwest. As Mr. Hood says, the prevailing wind is south about 30° to 40° west, or thereabouts. When it gets to that point it is behind Catalina Island, and from there it blows with greater violence. Catalina Island bears about due south from Point Firmin. When it passes that point you can notice instantly the change in the weather at San Pedro. Then it generally holds here quite a while. I have seen it hold there for thirty-six hours, blowing in this direction [showing]. Then it swings around again, and as it swings here beyond the west end of Catalina Island it blows over the point of San Pedro, and our trouble there is gone.

Mr. MORISON. Then your trouble is while the wind is still eastward of Catalina Island?

Captain POLHAMUS. When the wind is eastward of Catalina Island, in that point there from southeast to south, and it generally does not kick up much of a swell. It generally holds the strongest a little to the east of south, from south to southeast. There is where it blows with the most violence. That is my experience there for thirty-six years. I would also state in connection with that, that I had charge of the tugs and lighters there for the several companies for twenty-four years. We always had it arranged in San Francisco with the telegraph company to send us

word when a southeast gale blowing over 30 miles an hour was blowing at San Francisco, because those gales work down the coast. They come down ordinarily in about twenty-four or thirty hours. A violent gale would come down in twenty-one or twenty-two hours, but an ordinary one in thirty hours. If a gale was blowing over 30 miles an hour up there we would try to make everything snug at San Pedro. We would order the ships to go to sea and prepare for bad weather.

The CHAIRMAN. Many of the gales that they get on the northerly coast do not reach you?

Captain POLHAMUS. A great many. They telegraph a great many that would not come down.

Mr. MORISON. Then it was the southeast wind you feared?

Captain POLHAMUS. Winds starting in the southeast. After it passed and swung around here [showing] we were all right.

Mr. MORISON. Referring to that breakwater on the map to your right, how would that protect you from a southeast wind?

Captain POLHAMUS. A southeast wind, as I said before, is nearly the trend of the coast line. That map gets me [pointing to map].

The CHAIRMAN. That is about southeast?

Captain POLHAMUS. That is the shore line, [showing on map]. Of course, from the direct shore line there can not be much stress of weather. As soon as it drops a little bit further than that there you are as snug as a bug in a rug.

Mr. BURR. Do those southeast winds stir up very heavy swells?

Captain POLHAMUS. Yes, sir; as I mentioned before, the swell is more to the southward than the wind is, because of the trend of the prevailing swell at all seasons of the year being down the channel. They call it a northwest wind, but it is not. If you will notice on the chart of the State there, the winds down the coast follow the range of the coast mountains. North of San Francisco it is northwest. As you come down past Point Concepcion it turns more to the eastward; so our coast winds south of Point Concepcion are nearly westerly winds following the trend of the coast.

Mr. BURR. Have ships had any trouble in holding at San Pedro Bay? Have they dragged anchors for instance?

Captain POLHAMUS. The history of the *America* was after I left there. I left the company in 1884. I have never known of ships dragging anchor there unless by breaking their chain. A light anchor would hold, but a heavy chain was required. The holding ground is so good, it is generally the chain that goes. When I had charge of the lighters I had large chains put on the anchors. The chain was out of proportion to the anchor. The captain of the *Orizaba* called my attention to an instance of an anchor where the fluke was turned out in line of the shank.

The CHAIRMAN. You must have had a good sea running there to do that.

Captain POLHAMUS. There was. He was holding in there trying to do his work.

Mr. BURR. Have you known of any vessels that have actually dragged their anchors without parting their chains?

Captain POLHAMUS. There are instances where they have laid at anchor for some time and fouled their hawser; that is got their anchor fouled. That is the only instance where I have known an anchor to drag in San Pedro Bay. They had laid there a long time and had fouled their hawser.

Mr. MORGAN. What was the direction of the wind at the time of this accident?

Captain POLHAMUS. The anchor of the *Orizaba*?

Mr. MORGAN. At the time the vessel went ashore and dragged the anchor?

Captain POLHAMUS. That held in the southeast. I was not there at the time. I was an agent for the underwriters and came down to look. I was not there when she went in. She was anchored out here somewhere and went in in that direction [showing on map].

Mr. BURR. Have any ships been driven ashore there between Point Firmin and San Pedro?

Captain POLHAMUS. The brig *Collor*, when I was in the employ of the Southern Pacific Railroad, was anchored off in there [showing on map]. I got a wire from San Francisco as usual, and I told the captain to get out of there; that the weather was coming on bad. He says: "My vessel leaks, and if I start to make sail, she will fill with me. I am going to stay here and ride it out." The next morning his chain had parted as usual and the vessel was lying up on Timms Point. I said to the captain, "I am sorry for your misfortune." He said "Mine friend, my ship was insured." I said, "I wouldn't say anything about that, because it may get you in trouble." But it was so all the same. The barkentine *San Luis*, I think it was, got under way and went over here [showing on map], she stood on this tack and mistayed and went in on the beach. Those were the only two that I can remember of that went ashore there except the *Kennebec*. The *America* went in over the bar. The *Adelaide Cooper* dragged in over the bar.

The CHAIRMAN. In heavy weather, sailing vessels ordinarily get under way and go to sea?

Captain POLHAMUS. Those big English ships would generally make everything snug and drop the second anchor. The coasters would stand out over there, and as soon as you make a lee of that point [showing on map] the weather begins to moderate. The vessels go over there, shorten sail, lay there, and ride under the lee of that shore until the wind hauls to the westward and then they go to their anchorage again.

The CHAIRMAN. If you were in command of a sailing vessel and you thought a heavy southeaster was coming on, would you get under way and go to sea?

Captain POLHAMUS. Yes, sir; if I could get under way comfortably. I would slip out and go to sea if I could, under the present condition of things.

The CHAIRMAN. If you were the master of a vessel and there was a breakwater at San Pedro and one at Santa Monica and you wanted a refuge, which would you run for as a matter of choice?

Captain POLHAMUS. I would run for the lee of Catalina Island.

The CHAIRMAN. You do not understand my question. If there was a breakwater built at San Pedro and one at Port Los Angeles and you were in a sailing ship at sea and heavy weather was coming on, and you wanted a place of refuge, which of those two breakwaters would you prefer to run for and get under?

Captain POLHAMUS. Mr. President, my place of refuge would be the Pacific Ocean in a gale of wind. As has been said here a lee shore is a bad harbor. I would consider it so, too. I would not heave the ship to in a southeastern gale. As soon as the wind swings to the west then go for your harbor, but not for a lee shore harbor in a gale of wind.

Mr. MORISON. Is there good anchorage on the lee shore of Catalina Island?

Captain POLHAMUS. The water is very deep there and they don't anchor. They just come into the lee of the land and drift along.

Mr. MORISON. It is too deep to anchor all the way there?

Captain POLHAMUS. Except for small vessels, which go into Avalon Harbor. They come up in the lee of the harbor. If it is a small vessel they go into the isthmus or into Avalon. No matter how dark the night is, you can tell where you are; as soon as you come under the lee of that island it is as calm as a millpond.

The CHAIRMAN. Traders have done that ever since they first came on this coast?

Captain POLHAMUS. Yes, sir; Dana did it in 1837. The old mission captains used to do it. They would run for that island in bad weather.

The CHAIRMAN. At San Pedro the southeastern wind has a fetch of about 90 miles?

Captain POLHAMUS. The southeastern wind? No, sir.

The CHAIRMAN. The southeastern wind has a fetch of about 90 miles at San Pedro? It comes all the way from Point Loma and below, even?

Captain POLHAMUS. No, sir; not southeastern winds. A southeastern wind runs pretty well down to San Diego, but I thought it run a good deal higher up than this [showing on map].

The CHAIRMAN. Of course it would pick up something of a sea; a fetch of 90 miles would be bound to make a sea?

Captain POLHAMUS. Yes, sir; 90 miles would make pretty good swells.

The CHAIRMAN. Now, with regard to your anchors off San Pedro. You say that vessels go adrift there from parting chains and not dragging their anchors?

Captain POLHAMUS. In a majority of instances.

The CHAIRMAN. Is that because the anchors catch on rocky ledges?

Captain POLHAMUS. It is a hard clay bottom out there, most of the places, and the anchor bites in and holds good and hard. It is good holding ground.

The CHAIRMAN. You think they don't get hold of rock?

Captain POLHAMUS. The rocks in San Pedro Bay—I will explain to you, if you wish. The rocks in San Pedro Bay are loose. The kelp grows on those rocks, and, as Mr. Hood expressed it, often moves around. Sometimes you will see a rock no bigger than your fist with a large piece of kelp on it. A good many years ago I took notice of the rock at the point where the kelp was. I took lighters in there, and the men at low tide would gather the rocks in water so deep [showing]. Under the bottom of the rock we always found no ledge, but the clay of which the hill is formed. I think the railroad company bored up in that hill for water. You will sometimes find the rocks on the beach where they go in with the kelp to the lower of Deadmans Island.

The CHAIRMAN. Then you think it is stiff clay the anchors take hold of?

Captain POLHAMUS. It is stiff clay. Speaking of the kelp, when the kelp goes ashore there, or rock with kelp on, kelp will grow as long as the rock is not buried by the sand. As long as that rock is not buried by the sand the kelp will remain alive. As soon as the rock that has the kelp on is buried under the sand the kelp dies—showing that wherever kelp is growing on rock there can be no sand above the rock, and there can be no drifting sand.

The CHAIRMAN. How many ships have gone ashore at San Pedro in southeasters?

Captain POLHAMUS. As far as I remember, as I mentioned before, there were the *San Luis*, the *Callos*—they were not all ships, they were brigs, barks, and ships.

The CHAIRMAN. You needn't be exact.

Captain POLHAMUS. The *Kennebec* was sunk and brought up again. The *America* went over the bar. The *Adelaide Cooper* was a total loss, and the *Nick Biddle* ran over here [pointing on map toward Long Beach]. There was a lot of longshoremen working on the lumber. They told the captain he had better put to sea, as there was going to be a gale. He told them to mind their own business. They took off their shoes and stockings and got ready for the occasion. She was insured.

The CHAIRMAN. How long has it been since any deep-sea vessels have gone to San Pedro and anchored?

Captain POLHAMUS. I am away from there now, and I think the Southern Pacific Railroad can answer that better than I can. I don't know, sir.

The CHAIRMAN. Where are you living now, Captain?

Captain POLHAMUS. I am a pilot in San Diego. I have no interest in Los Angeles County; not a dollar.

The CHAIRMAN. You are now a San Diego pilot?

Captain POLHAMUS. Yes, sir.

Mr. BURR. When these ships were driven ashore, Captain, in what direction did the swell approach? Was it a southwest swell?

Captain POLHAMUS. That swell held longer than usual to the eastward of south. Long enough to send in a big sea there from that point. Ordinarily, it swings around quickly. I don't know exactly how long it did hold, but long enough to kick up a big swell and send them ashore; longer than the usual time.

Mr. BURR. In your opinion, does the difficulty in holding under these circumstances arise from the swell or from the wind?

Captain POLHAMUS. The swell. You can hold on from the wind, because it is a violent, steady pull; and the swell will catch her and send her back, and about the time there is a hard pull on the chain another sea will strike and something has to go.

Mr. BURR. Then is it your opinion if a breakwater were properly located so as to cut off the swell that the ship would hold?

Captain POLHAMUS. We would not have so much of a strain. A ship will lie along-side of a dock with a light line. But it is the surge.

Mr. BURR. Can you tell the greatest draft of vessel that you have taken through the channel at San Pedro? In the first place, let me ask whether you have acted as pilot in San Pedro since the present depth over the bar was attained?

Captain POLHAMUS. No, sir; I left in 1884. I don't think I have taken anything over the bar since. It was then about 14 feet or something of that kind; but that was long before the work was going on.

The CHAIRMAN. Have you ever known a vessel leaving San Pedro Harbor in any stage of wind and running to Santa Monica Bay for protection?

Captain POLHAMUS. No, sir.

The CHAIRMAN. Have you ever known a vessel to leave Santa Monica Bay and run to San Pedro during a gale of wind for protection?

Captain POLHAMUS. No, sir; I can not call that to mind.

Mr. MORGAN. Were you here yesterday, Captain?

Captain POLHAMUS. Yes, sir.

Mr. MORGAN. You heard Mr. Hawgood's remarks in regard to the effect of the breakwater at Santa Monica. He spoke, if you are able to recall it, of the angling in of the waves behind the breakwater.

Captain POLHAMUS. Yes, sir.

Mr. MORGAN. I would like to get your opinion in relation to that.

Captain POLHAMUS. I will make a few remarks later in relation to that, if you will permit me, in connection with something else, when the gentlemen get through asking their questions.

The CHAIRMAN. Captain, you will have to answer the question when it is put to you.

Captain POLHAMUS. All right, sir. What is your question?

Mr. MORGAN. The question is to what extent do the waves angle in back of an obstruction like that breakwater? The waves coming directly against the breakwater, how much would they angle in behind the breakwater, and to what extent?

Captain POLHAMUS. If the breakwater is across the path of the swell?

Mr. MORGAN. Yes, sir; directly across.

Captain POLHAMUS. It would whip around, I would say, to an angle that would depend on the velocity of the waves.

Mr. MORGAN. I am speaking of a severe storm that requires a breakwater.

Captain POLHAMUS. Forty to forty-five degrees or thereabouts.

Mr. MORGAN. That would be the case in any obstruction that would present itself squarely against the swell?

Captain POLHAMUS. Yes, sir; if it is on an oblique line, of course, it would be different.

Mr. MORGAN. As I understand you, the severest storms or the greatest force of a southeaster is directly against Catalina Island?

Captain POLHAMUS. Yes, sir. It varies. Sometimes the storm will be strongest when it is around there [showing]. Then sometimes it continues until it gets around here [showing]. It sometimes lulls and sometimes keeps on.

Mr. MORGAN. What I wanted to ask was if there was any change in this action—any natural condition that would change your opinion in regard to the angling in of the swells and storm from the direction of Catalina Island?

Captain POLHAMUS. I don't know that I understand your question, sir.

Mr. MORGAN. Say Catalina Island is a breakwater directly transverse to the storm, as this breakwater here. To what extent would the waves angle in from that island? Would it be 45°?

Captain POLHAMUS. The condition of the island and the breakwater is altogether different. In shoal water the waves will run up; around the end of an island like that where there are no soundings the ground swell don't break. It will not whip near as much in deep water.

Mr. MORGAN. About how much would you say it would angle in from Catalina Island?

Captain POLHAMUS. It would be hard for me to say. It is only supposition. I would like to state the facts I know; I can only give you a conjecture.

Mr. MORGAN. I will try to put it in another form. How near would you run to Catalina Island, if you went there for refuge from a storm, to lie pleasantly and safely during the storm? How near would you sail to it as a shipmaster?

Captain POLHAMUS. Within half a mile.

Mr. MORGAN. You would not, then, consider yourself as lying under the lee of the island if you were half way between Catalina and San Pedro?

Captain POLHAMUS. Yes, sir; partially. For every foot of the distance you go when you begin to start from San Pedro you can see a difference in the water moderating and smoothing as you go over.

Mr. MORGAN. But if you were going to seek protection you would run behind the breakwater or Catalina?

Captain POLHAMUS. I would run for Catalina Island and get behind it.

Mr. MORISON. When you run to Catalina Island you would have to lie to under sail; you would not be able to anchor?

Captain POLHAMUS. No, sir; let her drift. If she is up the channel, then she is to the windward, when the wind swings to come back.

The CHAIRMAN. The sea don't run around the ends of Catalina Island to make it rough behind?

Captain POLHAMUS. No, sir; not unless you are close to the end.

The CHAIRMAN. But it does around the end of a breakwater?

Captain POLHAMUS. In shoal water the sea is bound to whip around. I forgot to mention one vessel that went ashore, the bark *Amy*.

The CHAIRMAN. Did you ever lie in behind a breakwater in a ship?

Captain POLHAMUS. Yes, sir; partially constructed, not wholly built. Not in a ship but in tugs and lighters.

The CHAIRMAN. Didn't you find it a good deal smoother behind the breakwater than outside?

Captain POLHAMUS. Smoother behind the breakwater than outside; but near the end of it it was lumpy, until I got a ways in.

The CHAIRMAN. What breakwater was that?

Captain POLHAMUS. Port Harford; under construction now.

The CHAIRMAN. What was the length of it at the time you were lying in there?

Captain POLHAMUS. I can only make a guess.

The CHAIRMAN. Well, your opinion of the length.

Captain POLHAMUS. It is built out from Whalers Island quite a ways, and I would judge it roughly about 1,500 feet.

The CHAIRMAN. Here is a question I am asked to put to you. Can you make any statement as to the condition of the channel and bar of the inner harbor at San Pedro prior to the building of the jetties, and say if you know anything of sand movement in that vicinity?

Captain POLHAMUS. In 1860 I went to San Pedro in charge of the tugs and lighters, and remained with the different companies that had control there, first Banning, then the Southern Pacific Railroad, and then the Banning again, until 1884. The first eleven years I was there—from 1860 to 1871—there was less than 2 feet of water over the bar.

The CHAIRMAN. At low water?

Captain POLHAMUS. Yes, sir; at low water, and large spring tides less than a foot. I have often got out of the skiff to pull her over the bar and not went over my boot tops. The sands were constantly changing on the bar, and I had to avail myself of every inch of water to bring over the loaded lighters. The channel worked in this

form: Out here, where that line of breakwater is, the channel would be there [showing] for a while, and then this side, west of the island, was always the best and deepest. Then it would work down toward the island, until it got against the island, taking, ordinarily, about a year to get from the reef to the island. Then, when it got hard against the rocks, a small channel would break through the easterly end of the island. As that channel would increase the west channel would close up, until finally it was entirely closed. Then I would run in on the other side of the island. Then it would work in this way [showing], until, from a year to two and a half years, the bar would be this way from Deadmans Island down to the eastward. Then the channel would break through up here again to the westward, and this channel would close. Then it would work down again. That movement was continuous; sometimes it would take a little longer than others, but it had continued for the eleven years that I was there, until the channel was held in position by the breakwater being built there.

The CHAIRMAN. That shows a pretty large movement of sand. Where did that sand come from?

Captain POLHAMUS. Around the point there with the winds.

The CHAIRMAN. Where did it come from around the point?

Captain POLHAMUS. It is all the while drifting. The sand is all the while moving down this channel. It moves down like snow on the plains in a snowstorm. Any obstacle it meets with it drifts against.

Mr. MORISON. You mean by "down the channel" from Point Concepcion?

Captain POLHAMUS. Yes, sir. The drift of the sand is with the prevailing winds and with the contour of the coast line to the eastward.

The CHAIRMAN. Just outside of Rattlesnake Island there is at the present time quite a shoal of sand. Do you take it that that sand came from up the coast?

Captain POLHAMUS. Of that shoal I know nothing, but I would say it is either that or the sand that comes out of the channel and empties down there. There has been a great movement of sand out of the inner harbor of San Pedro—a great deal.

Mr. MORISON. What brought it out?

Captain POLHAMUS. The tide, sir. The ebb tide is the strongest. The flood tide comes up in two steps. First it is half flood, then half ebb, and then another rise, on the Pacific Coast. Then there is a flow from low water to high water. I have known instances where it would be 9 feet. That is unusual.

Mr. MORISON. Do you think that flow brings the sand from the whole of the interior basin or simply from the channel?

Captain POLHAMUS. I think from the line of the channel, up along the line of the channel.

The CHAIRMAN. That will do, Captain, thank you.

Captain POLHAMUS. I wish to make a few remarks in relation to this matter, if you will allow me.

The CHAIRMAN. If they are to the point.

Captain POLHAMUS. I think you will find them so. I would like to refer to that map of the State of California. Anywhere on that map where you see a projecting headland to the southward you will find under its lee either a good harbor or anchorage. For instance, San Bonita at San Francisco; San Diego at Point Loma; for a good anchorage, Port Harford, Point Concepcion, or Point Firmin, under the lee, clear of the drifting sands.

Mr. MORISON. How is it under that range of hills up in the bay of Santa Monica?

Captain POLHAMUS. If you anchor close under Point Dume it is very good, but when you get down to Santa Monica you are on a lee shore where the wind is right in [showing on map of California]. Up on Estero Bay there is a large tidal estuary on a lee shore, and all the water that comes in can not keep over a half a foot of water on the bar. Then coming nearer home there is Point Ballona. A few years ago they tried to make a harbor there. They sent to San Francisco and got the largest tug on the Pacific Coast, got her inside that estuary, and worked night and day on the channel. The trade winds were plugging away on the outside. The trade winds won, and they took the tug back to San Francisco.

Mr. MORISON. You say "tug". Do you mean a dredge or tug?

Captain POLHAMUS. I beg your pardon, I mean a dredge, the biggest they had on the coast. Some years ago, in 1892, when the soldiers camped at San Pedro, they couldn't get wood from anywhere but Malibu. There was a contract made to get wood from the Malibu Ranch up in there [pointing to west of Port Los Angeles], and I had charge for Banning in getting the wood off. We had to go up there with lighters and bring it off with a surfboat. On my first voyage I took a big wagon and harness and sent the teams around by land and went up with a surfboat. When I landed at the spot, I ran a surf line ashore and then went back for the wagon. It was knocked down. By mismanagement the surf boat coming ashore turned over, 300 feet from the shore line, in the outer breaker. While standing on the beach I saw one of the wheels coming up through the surf. There was considerable strug-

gle, but we succeeded in getting every piece of that wagon and harness and all the other material except one horse collar, showing that the sweep on that bottom tends to drive everything up on the beach to the coast line. The sand sometimes on this coast cuts queer freaks. Some years ago the old brig *Perpetua* ran ashore in a fog. They tried to get her afloat again and spent nearly all the brig was worth trying to float her, but finally gave it up. The sand banked against her, and the grass grew outside of her. There she lay abandoned some two or three years. One day a gale came on and the next day there was your *Perpetua* sailing up the harbor in Coos Bay with nobody aboard; she came in over the bar, and ran many years on the coast afterwards.

Mr. Corthell says that as an obstacle is met with, sand heaps up. I believe he made that statement. I do not think that is so always. Sand is like snow. Out on the plains where there is a post standing or telegraph pole you won't find snow up against that. You take a pile in a wharf and the sand will pot around it and deepen around that pile. It will deepen some places more than others. If there is hard pan it will deepen but little. If there is sand like Redondo, it will pot around it enough to take the pile out. When either sand or snow meets with an obstacle built right across its path, the condition is different, and as Mr. Corthell says, it will heap up, and heap up rapidly. You build a fence on the plains where the snow is drifting and it will heap against it. The sand in the ocean with the tide is the same as the snow on the plains. If it beats right against that obstacle it will heap.

When they first proposed to build a breakwater at Deadmans Island, General Alexander came down there to make a reconnaissance. The island was not then connected with the land. I took him over there. Before we got to Deadmans Island he said, "There is a reef running off in that direction, a boulder reef with sand." I said, "When were you here, General?" He said, "I never was here before." I said, "Did you see it on the chart?" He said, "I never saw a chart." I said, "Then how do you know it?" He said, "It is easy enough. Wherever there is a swell running against an island not in too deep water, the swell will sweep around both sides of that island carrying boulders and sand, and when they meet together they will drop." I wonder if the condition of that wharf [showing on map] would not be something like that.

Now, referring to the profile, I claim that a profile like that where the water comes in deep close up to the line of where the proposed breakwater is going to be, to any sailor or man familiar with the swell it will make a long slope like this [showing on map]. For evidence, gentlemen, go down to Santa Monica wharf when a ship is lying there with a westerly wind. See her surge backward and forward with a long swell. Then go to Redondo. There the ship has her nose in the breakers; she is jumping up and down in the swell. Captain Alexander testified the other day that she laid easier at Redondo. They find the same condition to exist at Newport. They built a wharf there, and it is a very easy wharf to lay at. If you go to Catalina Island you will find the water very quiet. The water is deep and the bottom of the sea is quite perpendicular. There is no long swell and no rolling ground swell.

In building the breakwater up at Port Harford I had a donkey on top of that wall. Part of the wall was perpendicular to deep water; then there was a long slope, and the water rushed up that slope and fetched my donkey over the wall into 75 feet of water inside the wall. I had to get a diver to find it.

When the old mission padres came to this coast they settled in the best valleys in this State, where the water was plenty and good. Everybody to-day claims they made the best selection in the country. Their old navigators hunted the shore just as the padres did the land—to find the best places for landing. At Santa Barbara and San Diego there was a landing for the missions of Los Angeles and San Gabriel. The nearest point on Santa Monica Bay to Los Angeles is about 14 miles. San Pedro is 26 miles, but they dragged their freight (the first 10 miles of it over a rough road) 26 miles from San Pedro to Los Angeles. They hauled freight from San Pedro 26 miles in preference to bringing it in to Santa Monica, where the distance was only 14 miles.

Speaking of how close you can work over the bar, I mean with what depth of water over the bar. At San Diego we have 21½ feet of water and we take ships in there drawing 27 feet. There is more swell there than there is over this bar, but it is protected. You would not have so much depth of water to get in.

Another thing I would mention in relation to this coast. Dana, who was here in 1837 and again in 1854, speaking of old Captain Wilson, who was with him, says that the conditions are changing. You will find it in his work, *Two Years Before the Mast*. He says the seasons are changing; getting more moderate. He says we have no such weather here as we had in 1837. Since I have been here, in 1880 (and Captain Alexander will bear me out), the seasons seem to moderate every year, and the weather appears to be better. It may come around in a cycle. But it is better than it was in 1862, because I have seen storms that I do not think any ocean wharf could stand.

Properly speaking, there is only one little stream that comes into Wilmington Harbor, or should come. That is Dominguez Creek. Some years ago, in 1864, the San Gabriel River (they call it the Los Angeles River, but it is the San Gabriel) broke through the open land and came into Wilmington. Banning tried to get white men to get it out. He could not get them to do the work, so he sent for a tribe of Indians, and kept them filled up on mescal, and they put in about 5,000 sacks to make a dam and turn the water back into the ocean. While he was doing that it was filling up very rapidly. If there is water going into that harbor, it should be stopped and all that water turned into the sea, except little Dominguez Creek, which runs a very few weeks in the year.

Mr. MORGAN. About how long does a southeaster last, Captain?

Captain POLHAMUS. They are very variable.

Mr. MORGAN. Well, generally about how long?

Captain POLHAMUS. Do you mean the whole continuation of the gale?

Mr. MORGAN. The severe part of the gale.

Captain POLHAMUS. You might as well ask how long a rain storm lasts. It varies from twelve hours to twenty-four hours or thirty-six hours. That is the sweep of the storm.

Mr. MORGAN. The entire storm?

Captain POLHAMUS. Yes, sir.

Mr. MORGAN. And the extreme length of time perhaps would be thirty-six or forty-eight hours?

Captain POLHAMUS. When I said thirty-six hours I meant three days. I have seen them blow three days. When I said thirty-six hours I was thinking of twelve hours to the day.

Mr. MORISON. How much of the three days is the storm a southeaster?

Captain POLHAMUS. Ordinarily it is seldom over twelve hours until the wind gets to the westward of south. I have seen it a little longer than that, but that is the exception to the general rule.

Mr. MORGAN. How long is it usually changing from southeast to southwest, that would be 90° of the storm?

Captain POLHAMUS. It is moving all the time very slowly. If you watch you will see it move. It is a slow move. Sometimes it will hold in one point, but ordinarily it is a slow move to the westward. When it gets beyond southwest it will sometimes whip quick, but the movement is generally slow. There may be a quick little gust of wind and then it changes.

Mr. MORGAN. After it starts to move around does it stop at any time and concentrate its force in one direction, or does it continue to go around?

Captain POLHAMUS. Where I live, when a storm starts to move around, it moves around steadily—either rapidly or slowly, but steadily—until it reaches the culminating point. It goes slowly; from west to northwest it generally goes quickly. Then there is a violent gust and it comes down. From south to west it travels slowly, a slow movement. Then comes that short quick gust, with a flurry of rain, perhaps, and then the thing is over.

The CHAIRMAN. Captain, what is the direction of the swell off Point Concepcion—the open-sea swell?

Captain POLHAMUS. Trending down with the coast line. It turns there. It bears down between Point Arguello and Point Concepcion.

The CHAIRMAN. What direction does the swell run at Point Arguello?

Captain POLHAMUS. Against Point Arguello?

The CHAIRMAN. Yes, sir.

Captain POLHAMUS. Turns against it.

The CHAIRMAN. From what direction? Is there southwest swell or west swell?

Captain POLHAMUS. It is more northwest there. It has more of a northwest run up there; then it passes Point Concepcion and turns more to the eastward.

The CHAIRMAN. Runs more to the eastward?

Captain POLHAMUS. Runs more to the eastward; yes, sir.

The CHAIRMAN. Now, to go back a little, from what direction does the wind blow hardest there, a southeaster?

Captain POLHAMUS. From the south, ordinarily speaking. That may be modified, but ordinarily from the south to southwest is the heaviest wind.

Mr. FRANCIS. We desire to present a delegation, through its chairman, Mr. Colin Stewart, the president of the Board of Trade of the city of Pasadena.

Mr. COLIN STEWART. Mr. Chairman and gentlemen of the Deep-Water Harbor Board, I have the pleasure of presenting a set of resolutions framed by the Board of Trade of Pasadena in favor of a deep-water harbor site at San Pedro. Do you wish to have them read?

The CHAIRMAN. Yes, sir; read them.

Mr. STEWART (reading):

"Rear-Admiral JOHN G. WALKER,

"Chairman, and Members of the Deep-Water Harbor Board for Southern California.

"GENTLEMEN: The Pasadena Board of Trade, representing a city of 12,000 population, beg to submit herewith a copy of the resolutions unanimously adopted at a meeting of said board December 23, 1896, to wit:

"Whereas the Deep-Water Harbor Board, now in session in Los Angeles, has been appointed to determine upon the location of a harbor to be constructed by our National Government either at San Pedro or Santa Monica; and

"Whereas said harbor should be so located and constructed as to accommodate to the fullest extent not only our rapidly growing coast trade, but our international commerce. It should afford not only anchorage for vessels and facilities for receiving and discharging their cargoes, but ample provision should be made for the erection of warehouses, building of repair docks, construction of interior basins and shipyards, and the appliances that are required by the shipping interests usually centered at a great harbor, as well as the freest possible access for the agencies of land transportation which the commerce of such a port will require; and

"Whereas it is the sense of this board that the site in San Pedro Bay heretofore selected by other Government experts affords superior facilities in regard to such requirements: Therefore

"Be it resolved, That the Pasadena Board of Trade recommends San Pedro Bay as the most favorable location for such a harbor.

"That these resolutions be signed by the president and secretary and spread upon the minutes of the Board of Trade, and that a committee be appointed to submit a copy hereof to the Deep-Water Harbor Board.

"COLIN STEWART, *President.*

"FRANK P. BOYNTON, *Secretary.*"

I would say, in connection with this, that a committee of five was appointed, of which I was selected as chairman, to present these resolutions. I would also say that on page 77 of the report of a hearing before the Committee on Commerce of the Senate of the United States, on the subject of a deep-water harbor in Southern California (copies of which document are in possession of the Board) appears a petition favoring San Pedro, signed by the leading business men of Los Angeles and Pasadena, to which petition I refer your honorable body.

Mr. FRANCIS. We desire to present as our next witness a gentleman who, I understand, has been a pilot at San Pedro for the past fifteen years, Capt. D. W. Weldt.

The CHAIRMAN. How long have you been a pilot at Wilmington and San Pedro?

Captain WELDT. About fifteen years.

The CHAIRMAN. Is San Pedro easy of access?

Captain WELDT. Yes, sir; in my opinion.

The CHAIRMAN. For what draft ships?

Captain WELDT. I have taken in as much as 19 feet.

The CHAIRMAN. That is exceptional, isn't it?

Captain WELDT. Exceptionally high water.

The CHAIRMAN. What would you say would be the ordinary draft?

Captain WELDT. Probably 18 feet.

The CHAIRMAN. What do you know about the currents in the bay of San Pedro?

Captain WELDT. Well, it has been my duty as pilot of the port to somewhat acquaint myself with the direction the currents run, and all that matter, as well as soundings. I spent a good deal of time in trying to find out the actual current that pursued the different indentures of the bay, and I came to the conclusion that there was not a great deal of current, but, what there was, the majority of it was setting east. To corroborate that statement, some twelve or more years ago—yes, some eighteen years ago—when I was quite young, I was with the engineer, Captain Sears, who had charge of the breakwater that was constructed there. I was with him a good deal of the time, particularly at night time. We were trying to find out the currents and how they would run in the different parts of the bay, and he told me that he concluded it was running that way. I thought so from the way that everything we placed in the way of buoys with flags on them, and so on, with great weights to them, would naturally have a tendency to go in the bay, and then off again down toward Anaheim Landing. Some were picked up on the beach at Las Bolsas. That is quite a ways down. From that and from my personal experience, I concluded that nine hours out of ten there would be a set to the eastward. Another reason I have for it is: I took a full-rigged ship down to Oceanside, about 15 miles to the westward of Point Loma, with a cargo of lumber. In discharging it there, the most of it went down toward False Bay. They didn't get only about half of it ashore. We couldn't swing the ship. She was eternally lying right in the trough of the sea, and we lay a mile offshore, too.

The CHAIRMAN. Was your ship anchored?

Captain WELDT. Anchored in the open sea.

The CHAIRMAN. What was the direction of the sea?

Captain WELDT. The wind would be the prevailing wind, west and west-northwest.

The CHAIRMAN. The current went with the wind?

Captain WELDT. Well, in a measure, yes.

The CHAIRMAN. Does the reef off Point Firmin shelter the anchorage?

Captain WELDT. It does, sir.

The CHAIRMAN. How much?

Captain WELDT. It shelters it that much that we don't have any destructive swell for 2 miles east or northeast of the point.

The CHAIRMAN. Are you familiar with Santa Monica Bay?

Captain WELDT. Somewhat.

The CHAIRMAN. Have you ever been there with ships?

Captain WELDT. Yes, sir; I took the first ship that ever went alongside the long wharf, the ship *India*.

The CHAIRMAN. Did you have any trouble in going there?

Captain WELDT. No, sir; perfectly smooth water.

The CHAIRMAN. Did you have any trouble in going to the wharf?

Captain WELDT. No.

The CHAIRMAN. Outside of the immediate neighborhood of the harbor, how about the currents at San Pedro, outside Point Firmin?

Captain WELDT. Out here [showing on map]?

The CHAIRMAN. Yes.

Captain WELDT. I have been trying hard for years to find out about it there as well as up along the island. I was cruising there to meet incoming ships, and I used to try and observe as closely as possible the trend of the current, but I discovered the moon had a good deal to do with it. A full moon would make it run for two or three days in one direction offshore, say 10 or 12 miles offshore. It had a tendency to go to the westward. Then with a new moon it would run offshore again to the east, and probably run that way for four or five days or as much as a week. That has been my personal experience.

The CHAIRMAN. If there was a breakwater at San Pedro and another at Port Los Angeles, and you wanted to get into a sheltered place, which would you prefer to run for?

Captain WELDT. Well, Mr. President, it would be owing a great deal to the condition of the weather. If the wind was southeast I would naturally seek shelter off a lee shore. I would not want to go on a lee shore; no practical mariner would.

The CHAIRMAN. Which of the two places would you prefer to go to?

Captain WELDT. Taking it all in all, if I were compelled to seek shelter I would prefer to go over to the island.

The CHAIRMAN. That is not answering the question. If there was a good breakwater to get under you would be perfectly safe. If for any reason, no matter what, you had the choice of those two places, which would you go to?

Captain WELDT. I would take San Pedro, by all means; but I would not, unless I was compelled to, go there under a lee shore.

The CHAIRMAN. Why would you go to San Pedro in preference to Port Los Angeles with a southeast wind?

Captain WELDT. I will tell you why. Because in my experience the prevailing swell of the coast is about west and west-southwest down the coast, and there, under the lee of the headlands at Point Firmin, we don't get that heavy swell. If you can get under the lee of a breakwater there, that breaks off the heavy swells from the southeast and the prevailing swells as well from the westward, I know I am protected in a way. That is my reason for going there.

The CHAIRMAN. If you look at the schemes for those two breakwaters, which would give you the better protection in a southeast wind; which location would give you the better protection?

Captain WELDT. Well, I would consider that there is not a great deal of difference in a southeaster.

The CHAIRMAN. At San Pedro a southeast wind would blow right into the mouth of the harbor?

Captain WELDT. Not altogether. It does to a certain extent, but not altogether. It comes from about this direction [showing on map].

The CHAIRMAN. If the sea runs around the end of a breakwater at an angle of 45°, would you have much space in there?

Captain WELDT. I have laid at anchor at San Pedro with large ships for days. My worst experience has not been altogether with the sea from the southeast. It was the heavy swell from the westward; as the wind would change, the southwest swell would cause the vessel to surge just like that on the chain [showing]. It was not the wind we feared. It was the sea that caused the parting of cables.

The CHAIRMAN. Wouldn't you be quite as well sheltered at Port Los Angeles, supposing that breakwater to be built, and you could get in behind it?

Captain WELDT. Probably I would. That remains to be seen. I don't know what protection it would afford, but I do know what protection that place has afforded for a good many years.

The CHAIRMAN. Is the holding ground good at San Pedro?

Captain WELDT. Yes, sir.

The CHAIRMAN. How about Santa Monica?

Captain WELDT. Santa Monica, I don't care to say anything about?

The CHAIRMAN. Do you know anything about the holding ground at Santa Monica?

Captain WELDT. Yes, sir.

The CHAIRMAN. Is it good or bad?

Captain WELDT. Some is good and some is not good.

The CHAIRMAN. How much have you been there?

Captain WELDT. I have been in and out of that place for over fifteen years—in and out of that bay, back and forth.

The CHAIRMAN. Have you anchored there frequently?

Captain WELDT. Yes, sir.

Mr. MORISON. What is the trouble with the poor holding ground?

Captain WELDT. I know my anchor would not hold in the poor holding ground. We drifted pretty nearly ashore there.

Mr. MORISON. Was it soft or hard?

Captain WELDT. It seemed to be a sandy formation. There was nothing on the anchor when we got it up; but, then, that was well in toward the land side.

Mr. BURR. At just what point of Santa Monica Bay was that where your ship drifted?

Captain WELDT. It was up under the Malibu Ranch in one place and then close down to where the canyon is, just abreast of it; close to where the present wharf is. That was prior to the time of the construction of this wharf. I have had experience in both of those places.

The CHAIRMAN. What was the cause of the ship *Respigadera* going ashore?

Captain WELDT. Well, misjudgment, in a way. He sailed her ashore in broad daylight. I had spoken him and offered my services to him off Point Vicente in the afternoon. There was a 10-knot breeze, and he sailed her ashore.

The CHAIRMAN. Bad management?

Captain WELDT. Bad management. That was the cause of it.

The CHAIRMAN. What was the cause of the *America* going ashore?

Captain WELDT. The cause of the *America* going ashore is this: In those days they had to stavedore their cargoes to a great extent. In fact, American vessels coming from abroad always did. They didn't leave more than about three or four men on board to take charge of the ship. The stavedores were on shore, and a southeaster came up just the night before she came ashore. The mate was giving her chain with a patent windlass which, I have no doubt, you gentlemen are familiar with. He raised the lever up, as the ship was being taken sternward. He didn't know when the end came, and instead of the chain being shackled, as we have them, in a secure place, it was shackled insecurely and pulled away. It passed over the windlass and she naturally had to go ashore. As luck would have it, she came in over the bar and landed at Deadmans Island, on the spit there or the east side of it. There she stayed until, with the assistance of a tug, we took her and landed her alongside of the wharf. There were no repairs made on her in San Pedro at all. They towed her to San Francisco and put some little repairs on her there. Her rudder post was strained, as well as her rudder gndgeons, but to-day she is carrying as much of a cargo as she did formerly.

The CHAIRMAN. What caused the ship *Kennebec* to strand?

Captain WELDT. The cause of the stranding of the ship *Kennebec* was that she was not anchored in a secure place. About a year ago I discovered a rock where now is a bell buoy erected upon it, and I told the captain on the same morning that the ship went ashore and notified him the morning that she went ashore that she was not in a secure place. He told me that he had good ground tackle, and I told him, "That is not going to save you. There is something there that will in all probability punch a hole through your bottom and you will be under water by 7 o'clock to-night;" and he says, "That's all right," and he thought it was all right, but by a quarter to 7 that ship was under water, and she struck three times upon the pinnacle of the rock which is placed upon the charts. She was subsequently raised, and it was found that only one or two planks were seriously injured.

The CHAIRMAN. Can you indicate upon the map about where that rock was?

Captain WELDT. The rock is on the northeast by north of this point about three-quarters of a mile.

The CHAIRMAN. What do you say about the *San Luis* stranding?

Captain WELDT. The *San Luis* was somewhat the same arrangement. He was advised by me, as well as by other seafaring men, to go to sea, but he hung on and

hung on, and when he parted cables his sails were all in the backstays, and it was difficult to get under way; so that he stood away to the eastward on the starboard tack and she mistayed with him, and therefore he lost ground, and in coming back on the port tack she mistayed with him right near the buoy, and therefore he naturally went ashore. He tried to wear away, but could not—didn't have room—and she came round high and dry there where the water was rather shallow.

The CHAIRMAN. What was the direction of the wind that day?

Captain WELDT. The wind was southeast, or about that.

The CHAIRMAN. What was the cause of the bark *Amy* coming to grief?

Captain WELDT. The bark *Amy* was lying at anchor among quite a number of ships and lighters at a time when we had an unprecedented gale, such as the people here had not seen for fifty years, even among the oldest residents, because it snowed, and that was something Los Angeles people had never seen for years in this locality. As I understand it, she parted her cable right in the stock of the anchor, and she naturally drifted down; but it was only a short distance to the reef where she went under—the reef under the light-house there.

The CHAIRMAN. She parted her chain?

Captain WELDT. She parted her chain.

The CHAIRMAN. How was it with the bark *Collor*?

Captain WELDT. The *Collor*. I believe you heard that stated by Captain Polhamus. He stated that she went off there and went in shore—naturally sailed there.

The CHAIRMAN. How about the *Lucy B. Burr*?

Captain WELDT. He anchored her in about 25 feet of water, or about 5½ fathoms, and by the time he had let out his cable she was on top of the beach, or close in, and she naturally struck the heel, and that was all the damage that was done to her was to her heel. She is all right now, I believe.

The CHAIRMAN. How with the *Nicholas Riddle*?

Captain WELDT. She went ashore in a similar way. She parted her cables and went ashore.

The CHAIRMAN. Do you know of any damage to the vessels at Santa Monica at the old wharf?

Captain WELDT. The bark *Frank Curtis* was lying there. In fact she had just come in alongside of the wharf with a cargo of coal. If I remember, it was for the Southern Pacific Company, and Captain Austin was master as well as owner of her. She got to thumping—didn't have water enough under her bottom—so she commenced thumping, and after a while a steamer, the *Santa Cruz*, came along and towed her away to San Pedro, and there she discharged her cargo.

The CHAIRMAN. That was at the old wharf?

Captain WELDT. That was at the old wharf, and a short time after that the wharf was torn down and abandoned.

Mr. BURR. Did any vessels go in over the bar at the time of the loss of the *Kennebec* and the *San Luis*?

Captain WELDT. Yes, sir; the schooner *Corsair* slipped her anchor and came in over the bar without an anchor and sailed up abreast of Bosky Island and got on a muddy place high and dry there. She discharged a portion of her cargo at Redondo. She would probably be drawing at the time she crossed there about 12 or 13 or possibly 14 feet.

The CHAIRMAN. Was there ever a vessel scuttled in the bay of San Pedro and raised again?

Captain WELDT. Yes, sir; the old *Kensington*. I took the ship in and the captain immediately went ashore and ordered an extra gang of men to go to work on her as he knew the ship was on fire. I saw the captain could not save the ship, and we set the men to work at her after hatchways and they could not do it. I was on board at the time, and so were several other English shipmasters, and the advice was that he scuttle the ship. Well, that was done. I told them I didn't think there would be any danger at all, and there would not be very much loss, as she would be at anchor and they would take no chances on her, and so they scuttled her. After the fire was out he pumped her out and she went from there to San Francisco, and she carried a cargo of grain home. In fact, there was no damage done to her bottom at all, for the captain wrote to me that when they put her on the dry dock there was no damage done to her bottom at all, except to the woodwork where she was on fire inside.

The CHAIRMAN. Was she a wooden ship?

Captain WELDT. No, sir; she was an iron ship.

The CHAIRMAN. Where was she scuttled? Show it on the map.

Captain WELDT. About there [pointing to a place at the bottom of the letter S at the beginning of the word San Pedro on the map]. Just abreast of Deadmans Island.

The CHAIRMAN. Have you ever seen vessels running out of Santa Monica Bay and into San Pedro in stress of weather?

Captain WELDT. Yes, sir.

The CHAIRMAN. What vessels?

Captain WELDT. The steamer *Albion* is one, and a three-masted schooner that belongs to Dolby & Carson.

The CHAIRMAN. What was the weather?

Captain WELDT. Well, the weather was southwest or south-southwest.

The CHAIRMAN. What is the difference in the length of tow necessary for ships taken in tow? What is the difference in distance between the two places—that is, how far is it necessary to tow at Santa Monica and how far at San Pedro?

Captain WELDT. At San Pedro they don't tow over twenty minutes, sometimes only ten minutes, outside of Deadmans Island. Of course it does not take long before they are out clear, and then they set sail. The square riggers, I wish to mention right here, will sail out there, with the exception of two or three, which have been compelled to hire a steamer; but I have pulled out nearly all the vessels, with the exception of two.

The CHAIRMAN. Out of the outer harbor?

Captain WELDT. Out of the outer harbor. Of course the inner harbor is a very difficult place to sail to. I have sailed a three-masted schooner in there.

The CHAIRMAN. The tow is a short tow?

Captain WELDT. The tow is a short tow and very inexpensive, comparatively speaking. Of course I don't want to say anything about the expense, but it is a short tow.

The CHAIRMAN. How is it at Port Los Angeles?

Captain WELDT. I have been over there when they have had to tow out, as well as being over there when they tow in, and I know that they tow quite a while and a good deal longer than they tow at San Pedro.

The CHAIRMAN. Is that because it is necessary or because it is pleasant?

Captain WELDT. I have an idea it was for the purpose of getting them out of Santa Monica bight, as it is called by all the shipmasters. They don't call it a bay. They call it a bight.

The CHAIRMAN. How long is it since any deep-water ship has brought a cargo to San Pedro, anchored outside, and discharged the cargo by lighters?

Captain WELDT. It has been a good many years now. The first ship that came there was the ship—I don't remember the name, but it was an English bark. She made two successive voyages there.

The CHAIRMAN. How many years ago would you say?

Captain WELDT. About eighteen or nineteen years ago.

The CHAIRMAN. How long has it been since the last one came there?

Captain WELDT. The last one came there about seven or eight months ago, or probably a little longer.

The CHAIRMAN. She discharged by lightering, did she?

Captain WELDT. No; she did not. Immediately after anchoring her, she was taken around to Port Los Angeles, and there discharged.

The CHAIRMAN. How long ago since the last deep-draft vessel came to San Pedro and discharged her cargo by lightering?

Captain WELDT. I would have to refresh my memory with my documents, but somewhere in the neighborhood of a year and a half; about a year, I might say.

The CHAIRMAN. Formerly ships came there a good deal?

Captain WELDT. Yes, sir.

The CHAIRMAN. Why don't they do so now?

Captain WELDT. Well, one reason is that the principal product that they brought to the port was coal for the Southern Pacific Company. The Southern Pacific Company are now carrying all of their coal pretty much with their own vessels, and they are taking it to Port Los Angeles, and therefore we are set back.

The CHAIRMAN. We saw the other day at Port Los Angeles a couple of seagoing vessels, a ship and a bark, deep-draft vessels, one from New York and the other from Hamburg. Why should they prefer going to Port Los Angeles instead of going to San Pedro?

Captain WELDT. The preference is not always accorded to the master of a vessel, and not always accorded to the owner of a vessel as well. It is to the charterer.

The CHAIRMAN. Why should the charterer prefer sending his vessel there?

Captain WELDT. Perhaps he has stipulated by some private agreement as to the different points of distribution of the cargo.

The CHAIRMAN. Wouldn't they be likely to get as good treatment at San Pedro as at Santa Monica?

Captain WELDT. Probably they would. I don't care to go into that, but probably they would.

The CHAIRMAN. Do more deep-draft vessels go to Santa Monica now than to San Pedro to discharge, aside from the Southern Pacific coast ships?

Captain WELDT. The most deep-draft vessels go, I think, to Port Los Angeles, for they are taking all the coal and all that there.

The CHAIRMAN. Well, aside from the Southern Pacific Company's ships. I don't refer to their colliers, but other vessels bringing cargoes of all kinds.

Captain WELDT. I will admit that they are getting away with all the ships.

The CHAIRMAN. What was the size of your boat when you tried to anchor in Port Los Angeles?

Captain WELDT. My vessel was about 40 tons and drew 12½ feet of water, or about that.

The CHAIRMAN. How near were you?

Captain WELDT. I judge about a mile from where I dragged; before that, I was closer to the shore.

The CHAIRMAN. How high do you estimate the storm waves running at Santa Monica and at San Pedro to be?

Captain WELDT. I never saw any storm in Santa Monica Bay to speak of, from the fact that I always managed to scull out of it, and get out of there. I never wanted to be in there in a storm. I always got out to sea.

The CHAIRMAN. Well, how high did the storm waves run at San Pedro?

Captain WELDT. I have seen them run pretty high there. About 10 feet or more, sometimes.

The CHAIRMAN. Like a heavy sea?

Captain WELDT. No; a chopped-up sea; a broken-up sea.

The CHAIRMAN. You don't mean a long, rolling sea, but a heavy sea that would trouble ships?

Captain WELDT. Yes, sir.

Mr. MORISON. From which direction did they come?

Captain WELDT. The prevailing swells down along the coast are a little more to the southward, but the tendency of the coast waves is nearly east and west.

Mr. MORISON. I mean, when the waves were 10 feet high, from which direction did those waves come?

Captain WELDT. Those came from the southeast.

Mr. MORISON. From the southeast?

Captain WELDT. Yes, sir. That is only my idea. Sometimes we imagine they are a hundred feet high at sea. It is difficult to compute them.

The CHAIRMAN. Can you give us some idea of the commerce of the port of San Pedro between 1884 and 1889 in deep-sea vessels? What is the largest number of deep-sea vessels you have seen lying at San Pedro anchorage at one time?

Captain WELDT. It would be difficult for me to state the amount of material that was carried in those vessels. That is the first question, isn't it?

The CHAIRMAN. Can you give us some idea of the commerce of the port of San Pedro between 1884 and 1889 in deep-sea vessels?

Captain WELDT. A good many thousand tons of them. I think there was as many as 27 or 28 ships in there at one time.

The CHAIRMAN. Between 1884 and 1889?

Captain WELDT. Yes, sir.

The CHAIRMAN. Anchored there at once?

Captain WELDT. Yes, sir.

The CHAIRMAN. What was the average of tonnage?

Captain WELDT. They are all the way from 500 tons up to 2,400 tons, somewhere along there. Two thousand four hundred tons I think was the largest, if I remember right.

The CHAIRMAN. Did you, during those five years, from 1884 to 1889, know of any deep-sea vessels going to sea from the anchorage at San Pedro during a southeast or any other storm?

Captain WELDT. Never.

The CHAIRMAN. Did you ever know, during the years mentioned, any deep sea vessel to be injured while in the San Pedro anchorage?

Captain WELDT. None; only those I have mentioned already, the *America* and the *Kennebec*. Outside of them, no English ship and no foreign ship has ever come to grief there during my thirty years' residence.

The CHAIRMAN. You spoke of two vessels leaving Santa Monica and coming to San Pedro for shelter. What place or port in Santa Monica Bay did they leave?

Captain WELDT. I don't just remember now; but if I remember right, the *Albion* came from Port Los Angeles and the other one came from Redondo.

Mr. BURR. Did you ever know a vessel to run from San Pedro Bay round into Santa Monica Bay for shelter?

Captain WELDT. No, sir.

Mr. MORGAN. You reside in San Pedro now?

Captain WELDT. Yes, sir.

Mr. MORGAN. You perhaps noticed the effect of the recent storm you had there?

Captain WELDT. Yes, sir.

Mr. MORGAN. A very considerable amount of material washed into the harbor. You noticed that?

Captain WELDT. In the inner harbor?

The CHAIRMAN. Yes, sir; into the inner harbor, back of the pier line. One or two of the streets were washed out there?

Captain WELDT. Yes, sir.

Mr. MORGAN. And the material came down and went into the bay. You noticed that?

Captain WELDT. Yes, sir.

Mr. MORGAN. Several hundred tons, more or less.

Captain WELDT. Yes, sir; shiploads of it.

Mr. MORGAN. I would like to inquire about the condition in the inner harbor, as to whether there has been shoaling back where it is represented there on the map? Whether you have any knowledge of shoaling taking place in there?

Captain WELDT. In the interior area? Do you mean the whole entire basin clear up as far as Wilmington?

Mr. MORGAN. Yes, sir.

Captain WELDT. In the last fifteen years or more there has not been any number of vessels going up or down here to Wilmington, and it is somewhat shoaled up in the mouth. I must admit that.

Mr. MORGAN. Well, you have been at San Pedro at times when great storms prevailed over the country here, and when the rivers were full and carrying material down to the sea? Los Angeles River runs through the harbor, does it not?

Captain WELDT. Not all, sir. It comes out here at the San Gabriel. Some of it does. There is only a small, little bit of a creek and it is dry half the time, with the exception of probably a week or so in the winter, when it may run a little. Comparatively speaking, there is no river at all. Here is the river, the San Gabriel, and that empties out here.

Mr. MORGAN. That is the San Gabriel River?

Captain WELDT. That is what I have reference to.

Mr. MORGAN. Where does the water of the Los Angeles River go?

Captain WELDT. A part of it comes here and a part through here [showing].

Mr. MORGAN. Does any of it go through the harbor?

Captain WELDT. It is true that some comes down in the winter months, but in the summer months they utilize all that water for irrigation purposes, and we don't see a drop coming down. Don't see any of it at all.

Mr. MORGAN. When those occurrences take place, is the water clear or does it carry a solution of material?

Captain WELDT. It does carry a very marked solution of debris, and all that matter is usually deposited.

Mr. MORGAN. And the material on the margin is the same as that on shore, and the sand or material that moves about is not entirely an erosion from the ocean shore—is not washed off the shore entirely, but comes down from the interior?

Captain WELDT. Oh, it washes off some, naturally, when the water is coming down with force. It will naturally wash off some of the shore unless there is a very hard bank that will hold the rush of the water. It is natural that some of it would wash out unless it is very hard.

Mr. MORGAN. That passes through the harbor and finds a resting place somewhere outside?

Captain WELDT. Not altogether; probably some of it does. There is no question but some of it does; but this water here at the bayou forms those little molds of mud, and so on, and, of course, this water comes down here and naturally spreads out and forms deposits. The most of the deposits are of material or debris that comes down with the river. As I said before, it is not of any great consequence. It could be diked off.

Mr. MORGAN. Where do you suppose that material came from that they have excavated there recently?

Captain WELDT. The material that they have excavated there? That was there probably for hundreds of years. I don't know.

Mr. MORGAN. You think that is the original material?

Captain WELDT. I think it is. I judge so, from the formation of the bank there. The deposit is of the same material that is on the bank there. Mr. Axman, the dredger, can explain that better.

Mr. MORGAN. I didn't know but you might know, too.

Captain WELDT. No, sir.

The CHAIRMAN. I see that the San Gabriel River empties across by Rattlesnake Island there into the bay?

Captain WELDT. Yes, sir.

The CHAIRMAN. Has not that been diverted by the Terminal Railway building a dike there?

Captain WELDT. If I understand it right they were naturally compelled to do so, for the time being, as their road was constantly washing out during the winter

months, and there was such an amount of water, an unprecedented amount of water, came down in the last rains that naturally they had to take some measure to try and stop it, and that is what they did.

The CHAIRMAN. Well, it is a fact that the water in that river is now discharged into Wilmington Bay?

Captain WELDT. Yes, sir.

The CHAIRMAN. And not into the ocean lower down?

Captain WELDT. No, sir.

The CHAIRMAN. If it is bringing down any sediment and depositing it, it is likely to deposit more or less of it in the inner harbor?

Captain WELDT. Yes, sir.

Mr. MORISON. The tendency of the work done by the Terminal Railway Company is to fill up Wilmington Lagoon?

Captain WELDT. Well, it is, yes, sir; to a great degree. That is my opinion. Of course I don't want to assume the responsibility there.

Mr. BURR. Is there a Government engineer stationed at either Wilmington or San Pedro at present?

Captain WELDT. No, sir; there is not. There is a man in charge of the works, but he is very ill in bed at the present time. His name is W. W. Barse.

Mr. GIBBONS. Mr. Chairman and gentlemen, while this matter is fresh it may not be improper for me to say that at the present time this matter of putting a little dam across there was a measure of temporary protection; it was done with the knowledge and consent of the Government officer in charge of the Pacific Coast work at San Francisco, with the understanding, of course, that before the period arrived when there would be any silt likely to be brought down in the river it would be removed. By the way, the San Gabriel River is put in wrong here. Every drop of water of the San Gabriel River is emptied up here. That is the Los Angeles River entirely, and before that river gets to running enough to bring down any silt that obstruction will be removed; and I desire to say further, if the Board care to inspect that river they will find that it probably does not run to-day 300 inches of water under the present condition of affairs into the bay of San Pedro.

Mr. RUDOLPH AXMAN was then introduced on behalf of San Pedro.

The CHAIRMAN. Mr. Axman, did you ever do any dredging at San Pedro Harbor?

Mr. AXMAN. Yes, sir.

The CHAIRMAN. Where did you put the material, or what became of it afterwards?

Mr. AXMAN. We carried the material about a mile east of Deadmans Island and dumped it there. When we began to dump there was about 18 feet of water, and by the time we finished the contract there was about 4 feet of water. The lighter would get stuck once in a while in low tide, and it seems as though the material we dumped stayed right there. It is there yet to-day.

The CHAIRMAN. What sort of material was that?

Mr. AXMAN. Quicksand, mud, and coarse yellow sand mixed with shells, blue clay, cobble stones, and all kinds of debris and silt.

The CHAIRMAN. Was it material which would be readily moved by a little current, or was it very heavy material?

Mr. AXMAN. Some light and some heavy. It was mixed.

Mr. MORISON. Where did it come from?

Mr. AXMAN. Out of the channel between the Southern Pacific Wharf and Deadmans Island.

Mr. MORISON. Between the two jetties?

Mr. AXMAN. Yes, sir. A channel was made 300 feet wide and 16 feet deep. The former depth varied from 7 feet to 14 feet, and we brought it down to a 16-foot depth.

Mr. MORISON. How did you dredge it?

Mr. AXMAN. With an endless-chain bucket dredge.

Mr. BURR. You dumped this material just outside of the jetty?

Mr. AXMAN. A mile east of Deadmans Island; out in this direction [showing].

Mr. MORISON. Did you do that work by contract?

Mr. AXMAN. Yes, sir.

The CHAIRMAN. What have you to say about the direction of currents about San Pedro?

Mr. AXMAN. When we dumped the lighters we could see some of the light material, which would make the water muddy, floating toward Long Beach. That is, east of the place where we dumped. I never saw any going in any other direction. It was even so much so that some of the Long Beach people, who were bathing there, complained about it to the Government officers.

The CHAIRMAN. What do you know about the character of the bottom inside of the San Pedro Harbor?

Mr. AXMAN. My experience has been in excavating there, from Smiths Island out to Deadmans Island, that the material varies in different places. As Mr. Hooper stated this morning, there is a kind of a blanket of cement gravel or a crust, but when we got through that it is soft.

The CHAIRMAN. How thick a crust was that?

Mr. AXMAN. It varies from 2 or 3 inches to about 6 or 8 inches. I never saw any thicker than that. The most of the material is sand.

The CHAIRMAN. Underneath that blanket, what is it?

Mr. AXMAN. Sand, and sometimes you strike a streak of clay. Near Deadmans Island there is what we call The Reef, that runs from Timms Point over toward Deadmans Island, and it is a thin ledge of reef material. It is not solid rock, but more of a blanket-like rock.

The CHAIRMAN. How do you know that it is thin?

Mr. AXMAN. Because we picked it up with an endless-chain bucket and used to bring up pieces of it.

The CHAIRMAN. Do you know whether any borings have been made to get through there?

Mr. AXMAN. Yes, sir; the Government did some boring there, and raised up some of the hard material, which was mixed considerably with cobbles. They would set off blasts there, just before the beginning of the strongest ebb tide, and let it take it out.

Mr. BURR. How deep were the borings that the Government officials made?

Mr. AXMAN. About 16 feet below water.

The CHAIRMAN. Then they went into the bottom only a couple of feet?

Mr. AXMAN. Yes, sir; because that was sufficient to go through that crust, and then they got into soft material and they didn't go down, for the reason the powder would get into it and they would not have to use much force there, because it would be so shallow.

The CHAIRMAN. These borings were made for the purpose of examination?

Mr. AXMAN. No, sir. The Government has made borings, though, but I am not in charge and can not testify about that.

Mr. RODGERS. Do you know of any rock bottom between the jetties?

Mr. AXMAN. No, sir; I don't know of any.

Mr. RODGERS. I understand there is rock bottom somewhere, which the engineers have been excavating. Did you have any such rock?

Mr. AXMAN. Why, that is practically removed. There was one there once, that varied in shape, running from Timms Point toward Deadmans Island. That has been broken up and pretty nearly all moved out.

Mr. RODGERS. Is it soft material or rock below that?

Mr. AXMAN. The rock only seems to be blanket-like and lies irregular, and pitches at a little different angle—about 45°.

Mr. BURR. You stated that some rock had been taken out of the channel between Timms Point and Deadmans Island. I understood you to say that it had been taken out of the channel at that point?

Mr. AXMAN. Yes, sir.

Mr. BURR. What is there beneath that rock that you have taken out?

Mr. AXMAN. Soft material; sand mostly.

Mr. BURR. No more rock, but soft material?

Mr. AXMAN. Soft material is all we have found below there. We used to take a steel rod five-eighths of an inch in diameter and run it down for 20 feet, and keep churning it, and have no trouble in getting it down.

Mr. BURR. You say the present Government engineer is Mr. Barse?

Mr. AXMAN. Yes, sir.

Mr. BURR. Did he have charge of the immediate operation of deepening that channel during the time that you were dredging?

Mr. AXMAN. Yes, sir; that is, he was only the subordinate.

Mr. BURR. But he had the position of foreman or superintendent, I suppose?

Mr. AXMAN. Yes, sir.

Mr. BURR. Did you find any rock anywhere else in the channel except at this point between Timms Point and Deadmans Island?

Mr. AXMAN. Yes, sir. We found some when we were at work last year in front of Bookys Island. There was only a thin layer of it, what you would call a blanket ledge.

Mr. BURR. How far is that from Deadmans Island?

Mr. AXMAN. About 10,000 feet.

Mr. BURR. Can you indicate on the map about where that was?

(Position indicated on map.)

Mr. BURR. Was that rock, or was it cemented gravel?

Mr. AXMAN. It was more of a firm sandstone.

Mr. BURR. And only a thin layer?

Mr. AXMAN. Yes, sir. I didn't see any more than 2 inches thick. That is about the thickest we ever got out of that section.

Mr. BURR. Underneath that was what?

Mr. AXMAN. Soft material again.

Mr. BURR. What kind of soft material?

Mr. AXMAN. Mostly coarse sand.

Mr. MORISON. Taking the material that is now at the bottom of that channel, as you are familiar with dredging it, about how expensive material is it to remove?

Mr. AXMAN. In comparing it with other work, it is perhaps a little above the average.

Mr. MORISON. A little more expensive?

Mr. AXMAN. A little higher, for the reason that the sand is a little heavier, using it with modern methods of dredging.

Mr. MORISON. Is it a material which you can dredge by a pump?

Mr. AXMAN. Yes, sir; they did so last year.

Mr. MORISON. A pump and a cutter?

Mr. AXMAN. Yes, sir.

Mr. MORISON. That is, you could dredge the whole channel there in that way now, could you?

Mr. AXMAN. You could, with the exception of a few small places. I think a clam-shell dredge would be essential in some places, but that even would not be required if the mouth of the harbor was protected.

Mr. MORISON. It would not be required then?

Mr. AXMAN. I am speaking with regard to the swell, because you could not very well lie on the spud. You would naturally be compelled to lay to a cable.

Mr. MORISON. How much swell do you get in there?

Mr. AXMAN. Well, it would not interfere much with a vessel, but it would interfere to lay to a spud, as the spud binds the machine right to the side.

Mr. MORISON. How much would your boat go up and down without a spud?

Mr. AXMAN. About a foot or so, rise and fall.

Mr. MORISON. When the channel is dredged, does it remain at the full depth, or does it fill up?

Mr. AXMAN. It has been my experience that it has deepened; it has scoured. I am sorry to say it, because it rather interferes with my business.

Mr. MORISON. Then you would like to see it fill up so you would have some business?

Mr. AXMAN. Yes, sir; I was trying to get with the Terminal Company, and throw up the place and quit the job; for I had been out quite a while.

Mr. MORISON. Do you know anything of the rock ledge reported by the Government engineers in the channel near Deadmans Island?

Mr. AXMAN. No, sir; I don't know of any ledge, and I think I know every inch nearly of the entire bottom there. The ledge was there but it has been removed.

Mr. MORISON. Did you remove it?

Mr. AXMAN. No, I did not; but the foreman, or the man in charge of the break-water there, removed it.

Mr. MORISON. How did he remove it?

Mr. AXMAN. Why he blasted it up in small fragments, and the material that was underneath, the tide swept away, and the heavy part dropped down into the hole.

Mr. MORISON. So it is still down there?

Mr. AXMAN. It is there yet, but all broken up in small pieces.

Mr. MORISON. What is it?

Mr. AXMAN. It is sandstone.

Mr. MORISON. How big was it, a continuance of the ledge, or a boulder?

Mr. AXMAN. It only lay in blankets.

Mr. MORISON. How thick was it?

Mr. AXMAN. The thickest piece I saw, I don't suppose was over 6 inches. I will also state in regard to the channel, that when we tried our new machine, which was an endless-chain bucket dredge, we made the water outside of the channel, east of the Southern Pacific Wharf, and supposed to be all quicksand there, and we dug a hole down there about 16 feet deep, and that remained there for three years. I have not visited it lately, but for that three years that hole stayed there and never filled up, and it was rather a surprise to me. It may be there yet.

Mr. MORISON. Do you mean 16 feet below the water surface, or below the bottom?

Mr. AXMAN. Below the sand. It was not perpendicular, but it was sloped, and it was a surprise to me that it didn't fill up.

Mr. MORISON. How deep was it below low water?

Mr. AXMAN. Nearly 24 feet.

Mr. MORISON. Where is your endless-chain dredge now?

Mr. AXMAN. We have changed it to a hydraulic dredge.

Mr. MORISON. And that is now at San Pedro?

Mr. AXMAN. Yes, sir.

Mr. MORISON. And you think you could do any work with that hydraulic dredge that you have done with the endless-chain dredge.

Mr. AXMAN. Yes, sir; we can do it to better satisfaction, and we can do it much cheaper.

Mr. MORISON. You can work what hard material you expect to find there?

Mr. AXMAN. Equally as hard; yes, sir.

Mr. MORISON. Do you suppose you could take that hydraulic dredge and dredge a channel 30 feet deep there?

Mr. AXMAN. Yes, sir.

Mr. MORGAN. This Board contemplates making some investigation under its own direction, and it may be of value. Now, to correct a mistake, or what I think has been a mistake on your part, in designating where you deposited the material taken from the channel, will you please point out where you deposited the material there?

Mr. AXMAN. What I took out last year I deposited on the island here.

Mr. MORGAN. I mean that which you took outside and deposited there.

Mr. AXMAN. About a mile east of Deadmans Island [showing].

Mr. MORGAN. My recollection of your testimony is that you stated it was south of Deadmans Island, and I think the notes will read "south."

Mr. AXMAN. Then I made a mistake.

Capt. A. J. JOHNSON was next introduced.

The CHAIRMAN. Captain, where are you employed?

Mr. JOHNSON. I was employed on the bark *Enoch Talbot*. She used to belong to Captain Sanderson, of San Francisco, and the oil firm at Los Angeles bought her while I was on her and converted her into an oil ship.

The CHAIRMAN. Are you in her still?

Mr. JOHNSON. No, sir; she is laid up.

The CHAIRMAN. How long have you been on this coast?

Mr. JOHNSON. Twelve years.

The CHAIRMAN. Following the sea all the time?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. What are you doing now?

Mr. JOHNSON. I am in San Francisco now.

The CHAIRMAN. Not on board, and don't belong to the ship?

Mr. JOHNSON. No, sir.

The CHAIRMAN. Have you commanded ships?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. Where have you been running?

Mr. JOHNSON. My first voyage was from San Francisco to Tacoma, and from there to Guatemala, Central America, and then others on the coast.

The CHAIRMAN. Have you been much to these two places, Port Los Angeles and San Pedro?

Mr. JOHNSON. I have been twice at Port Los Angeles, three times to Redondo, and I was master of the *Enoch Talbot* to San Pedro. I was there twice. I was chief officer of several ships in San Pedro.

The CHAIRMAN. What draft ships have you been to San Pedro in?

Mr. JOHNSON. I came out over the bar with 18 feet 4 inches.

The CHAIRMAN. Then you went into the inner harbor, did you?

Mr. JOHNSON. Yes, sir; I loaded in the inner harbor.

The CHAIRMAN. Have you ever laid at anchor outside at any time?

Mr. JOHNSON. I laid three days there at anchor.

The CHAIRMAN. In good weather or bad?

Mr. JOHNSON. Pretty good weather.

The CHAIRMAN. What was your experience at Port Los Angeles?

Mr. JOHNSON. It ain't a very nice place for any ship to lay there, especially with the cargo I have—long lumber. It is not a nice place.

The CHAIRMAN. What is the matter with it?

Mr. JOHNSON. It has too much undertow, and a heavy swell setting in always.

The CHAIRMAN. Is it worse than Redondo?

Mr. JOHNSON. It is far worse than Redondo.

The CHAIRMAN. With a northwesterly or westerly wind?

Mr. JOHNSON. A westerly wind.

The CHAIRMAN. How long did you command the *Enoch Talbot*?

Mr. JOHNSON. Twenty-eight months.

The CHAIRMAN. Have you had any experience in hard gales on this part of the coast?

Mr. JOHNSON. Yes, sir; I left San Pedro in a gale from the southeast.

The CHAIRMAN. You left there in a gale from the southeast?

Mr. JOHNSON. Yes, sir; towing out over the bar.

The CHAIRMAN. Where did you go?

Mr. JOHNSON. I was bound for San Francisco.

The CHAIRMAN. You left because you had discharged and was ready to go?

Mr. JOHNSON. I was ready to go; yes, sir.

The CHAIRMAN. A southeast wind was a fair wind for you?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. Did you unload a cargo of lumber at Port Los Angeles?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. Did you have any trouble about it?

Mr. JOHNSON. Yes, sir; it took me twenty-two days to unload.

The CHAIRMAN. Why did it take you so long?

Mr. JOHNSON. Because I had long lumber, and it was put in through the bow ports of the ship, and I had to take it out of the hatchway and could only hoist one and two pieces at a time.

The CHAIRMAN. Couldn't you use your bow ports?

Mr. JOHNSON. No, sir; there is no ship can open her bow ports in Port Los Angeles.

The CHAIRMAN. Did you hoist it out by steam, or did you hoist it out yourself?

Mr. JOHNSON. I hoisted it out by steam on board the ship.

The CHAIRMAN. Were you in any hurry to get out, or did you have lots of time to stay at Port Los Angeles?

Mr. JOHNSON. Oh, no. We are always in a hurry, and always drive as fast as we can.

Mr. MORISON. Could you use your bow ports at Redondo?

Mr. JOHNSON. No, sir; not at Redondo, either. You could use no bow ports there. I was on a small ship or a schooner at Redondo, where we hoisted out of the main hatch.

Mr. MORISON. Would you use bow ports in San Pedro, if anchored in the outer harbor?

Mr. JOHNSON. Not on the same ship. I have been at San Pedro several times, when I discharged through the bow ports.

Mr. MORISON. Outside or inside?

Mr. JOHNSON. Outside.

The CHAIRMAN. Why can not you use your bow ports at Port Los Angeles?

Mr. JOHNSON. All the people at the wharf admitted that it was the finest weather they ever had there while I was there at the wharf, and yet the wash of the swell was high over my bow ports.

The CHAIRMAN. When you went out of San Pedro in that gale of wind bound for San Francisco, where did you go?

Mr. JOHNSON. I was bound for San Francisco, with a fair wind.

The CHAIRMAN. And you went straight up the coast?

Mr. JOHNSON. Yes, sir.

Mr. MORISON. Were you ever ordered not to land at Port Los Angeles?

Mr. JOHNSON. Well, this was the same voyage. When I started from San Pedro the wind was from the southeast. I came out until I got to Catalina Island, and it came in then from the southwest, and that headed me off to Santa Monica. I was beating around there the whole afternoon and the next night, and the following afternoon, I was thinking about going into Port Los Angeles to see how it looked, because my owners told me if there was no wind to put into Port Los Angeles and take on some more oil, but if I had a fair wind to keep on my course for San Francisco. I could not make any progress, so I thought I would go in to Port Los Angeles; but I never went in there that afternoon with the intention of anchoring there, because no ship could anchor in there. The swell was too high. I stayed there about 11 miles off, and Captain Dornfeld came out and asked me where I was going. I said that I was going in there to see how he was getting along, but I intended to stand off to sea and come back as soon as the swell had gone down.

Mr. MORISON. Then what did you do?

Mr. JOHNSON. I stood off toward Catalina Island, and the following afternoon I went back to San Pedro.

Mr. MORISON. Why did you go back when you had started for San Francisco?

Mr. JOHNSON. Because my oil pump was all plugged up with shavings and I could not use it, and had to go back for repairs.

Mr. MORISON. How old a ship is the *Enoch Talbot*?

Mr. JOHNSON. She was built in 1854.

Mr. MORISON. What is her present condition?

Mr. JOHNSON. She is a very good old lumber ship yet. Better than the majority of the old ships. I would not be scared to carry a load of coal on her yet.

Mr. MORISON. Do you know what rating she has now?

Mr. JOHNSON. No; she has no rate. They don't rate these old coasters.

The CHAIRMAN. Where did you get the wind the hardest during that gale; from what direction?

Mr. JOHNSON. When I left San Pedro I left with two upper topsails and a foresail and staysails, and in coming from the southeast I had to lower our two higher topsails and run under mainsail, staysail, and foretopsail and stud'n sails.

The CHAIRMAN. Then it blew hardest from the southwest?

Mr. JOHNSON. It blew hardest from the southwest; yes, sir.

The CHAIRMAN. When Captain Dornfeld spoke to you off Port Los Angeles, what did he say?

Mr. JOHNSON. He told me not to go in there if I didn't want to go on the beach.

The CHAIRMAN. After reporting at San Pedro, did you go back to Port Los Angeles?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. What for?

Mr. JOHNSON. To take on some more cargo of oil.

The CHAIRMAN. And then you sailed from there to San Francisco?

Mr. JOHNSON. I towed out, and started for San Francisco; yes, sir.

Mr. MORISON. You took your oil the second time at Port Los Angeles?

Mr. JOHNSON. Yes, sir.

Mr. MORISON. And sailed to San Francisco?

Mr. JOHNSON. Yes, sir.

Mr. MORISON. And got there all right?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. Then you went into San Pedro to repair your pump?

Mr. JOHNSON. Yes, sir.

The CHAIRMAN. That was the cause of your going there?

Mr. JOHNSON. Yes, sir.

Mr. MORISON. When you say "the oil pump," what do you mean?

Mr. JOHNSON. A pump to pump oil out of the tanks. The tanks were leaking, and the oil getting in the hold of the ship, and when this pump was blocked up I had no way of pumping it out of the hold of the ship back into the tanks, and I didn't want to pump it overboard, and that is why I went back.

Mr. MORISON. Was that a power pump or a hand pump?

Mr. JOHNSON. A big Worthington steam pump, throwing about 30,000 gallons an hour.

Mr. MORISON. How did you make your steam?

Mr. JOHNSON. We had a tank boiler on board the ship.

Mr. MORISON. What was your fuel?

Mr. JOHNSON. I was burning oil at the time.

The CHAIRMAN. How far did you have to tow out from Port Los Angeles?

Mr. JOHNSON. I suppose about 10 miles.

The CHAIRMAN. How was the wind when you left there?

Mr. JOHNSON. There was hardly any wind at all. A light air from the westward.

The CHAIRMAN. Did he charge you anything more for towing the 10 miles than for 5?

Mr. JOHNSON. Yes sir; it cost more to tow, because it is much farther to get outside of Point Dume.

Mr. MORGAN. At the time you sailed out of San Pedro in a southeaster, what course did you take?

Mr. JOHNSON. I set my course right for the west end of Catalina Island.

Mr. MORGAN. That would be a little west of south?

Mr. JOHNSON. Yes, sir.

Mr. MORGAN. And you laid under the lee of Catalina Island all that night?

Mr. JOHNSON. No, sir; I got as far as the west end of Catalina Island, and then it came in from the southwest and I headed off for Santa Monica. I couldn't get back under the lee of the island.

The hearing was then adjourned until December 26, 1896.

FIFTH DAY.

DECEMBER 26, 1896.

The meeting was called to order at 10 a. m., pursuant to adjournment.

Mr. FRANCIS. Mr. Chairman, we would like to call Mr. Stovall.

Mr. MOORE. Mr. Stovall, will you please state your name and where you reside?

Mr. STOVALL. Thomas Stovall; Long Beach.

Mr. MOORE. How long have you been there?

Mr. STOVALL. Ten years.

Mr. MOORE. Mr. Stovall, do you know anything as to drift coming upon Long Beach, or anything of that kind, indicating the direction of the current there?

Mr. STOVALL. I hardly understand what you mean.

Mr. MOORE. Do you know of any material drifting from the direction of San Pedro to Long Beach?

Mr. STOVALL. Yes, sir.

Mr. MOORE. State to the Board what you know about it.

Mr. STOVALL. I know at the time of the wreck of colliers there, and even when they were unloading colliers, the coal used to drift to Long Beach, especially at the time that English vessel got wrecked there. We used to get a great deal of coal on the shore at Long Beach, between the new wharf and the mouth of the river.

Mr. MOORE. Do you know the name of that vessel?

Mr. STOVALL. I do not, sir.

Mr. MOORE. Was it the *Respigadera*?

Mr. STOVALL. I think that is the name; yes, sir. And previous to that, at the time that the vessels were unloading coal, we used to pick coal up all the time along the beach. And at the time they dredged the inner harbor (I was one of the city council then) it covered our beach with a lot of driftwood, and we made complaint at the time to the man that was dredging. The beach was very much covered with that material that came out of the harbor at the time that they dredged there.

Mr. MOORE. Was that drift noticeable at all seasons of the year?

Mr. STOVALL. No, sir; only at that time, but the coal came all seasons of the year, but the colliers haven't unloaded there since. We haven't had any this last year or the year before.

Mr. MOORE. That is all.

Mr. MORISON. When you say a great deal of coal, how much do you mean?

Mr. STOVALL. I could get my light wagon full at a time.

Mr. MORISON. That would be half a ton?

Mr. STOVALL. No; not so much as that; it is a light wagon that I have. It might be a quarter of a ton, perhaps.

Mr. MORISON. How much coal was there in the ship when she was wrecked?

Mr. STOVALL. I don't know, sir.

Mr. MORISON. A thousand tons would you think?

Mr. STOVALL. I don't know anything about that. I know that I was not the only one; nearly all the people at Long Beach supplied themselves with coal that winter.

Mr. MORISON. How much do you think was picked up there from that wreck?

Mr. STOVALL. Really I couldn't tell, sir; there were so many picking at a time. I know I used to drive my wife down on the beach, and the coal looked so tempting we thought we might as well take it home.

Mr. MORISON. You filled your wagon several times?

Mr. STOVALL. Yes, sir; I guess twenty times or more.

Mr. MOORE. Do you know where that ship was wrecked?

Mr. STOVALL. I know she was wrecked at San Pedro, and that is all I know.

Mr. MOORE. Was it at Point Firmin?

Mr. STOVALL. I think it was the Long Beach side of Point Firmin, between there and Deadmans Island.

The CHAIRMAN. To the east of Deadmans Island?

Mr. STOVALL. Yes, sir; to the east of Deadmans Island.

Mr. MOORE. Can you point out on the map about where you mean?

Mr. STOVALL. I should judge it was somewhere about there [pointing].

Mr. BURR. You say that some coal drifted over to Long Beach from that which was lost overboard from the colliers from time to time?

Mr. STOVALL. Yes, sir.

Mr. BURR. Did very much coal drift over there from these colliers, or was it only an occasional piece?

Mr. STOVALL. Well, an occasional piece. They used to be some distance apart before this wreck, but enough for us to get considerable coal every time we went down on the beach.

Mr. BURR. From the colliers or from the wreck?

Mr. STOVALL. No; I am speaking now from the colliers before the wreck. Before that wreck we used to get some there every time we went on the beach.

Mr. BURR. There was enough drifted over there to enable you to collect—

Mr. STOVALL. There were some families in Long Beach that almost used to supply themselves in the winter time with coal that drifted across from the colliers, where they dropped it in loading on to the lighters, I suppose. Then another thing. My wife is a great woman for shells, and we found rock oysters on Deadmans Island and likewise on the breakwater.

Mr. BURR. Do you know where these colliers were anchored?

Mr. STOVALL. Yes, sir; we would see them from Long Beach. They were generally anchored off Deadmans Island, between there and Point Firmin.

Mr. MORGAN. You have been long enough at the beach to understand the general direction of the waves that come in on the beach, I suppose, have you not?

Mr. STOVALL. Well, I have not taken particular notice of that.

Mr. MORGAN. You have not noticed the waves?

Mr. STOVALL. I have a little, too, because I was interested in the building of the wharf and I advised them to go out so far to get beyond the breakers, and that is all.

Mr. MORGAN. You have no idea which direction they come from?

Mr. STOVALL. Yes, sir; they generally have come, without it was a southeast wind that would come from the other quarter, they generally came right straight from San Pedro; from the west.

Mr. MORGAN. When a southeast wind prevails, the waves strike the beach quartering, do they not?

Mr. STOVALL. Yes, sir; kind of sideways.

Mr. MORGAN. Which way do the waves run?

Mr. STOVALL. They generally go—

Mr. MORGAN. Run toward San Pedro or from—

Mr. STOVALL. Go toward north or northeast.

Mr. MORGAN. Generally the angle is to the north?

Mr. STOVALL. Yes, sir. Another thing that I have noticed about the current there is that when we have considerable rains, the water that comes out of the river does not go very far out to sea; it larkens the water. I am fond of fishing, and I know it used to spoil our fishing when we had muddy water and it didn't go very far out to sea, and then we would have to go out in a boat to catch fish beyond that water, and it is evident to me that the current was toward Long Beach in keeping that muddy water so near our shore as it did.

Mr. FRANCIS. Mr. Chairman, we would like to present Captain Smith.

Mr. MOORE. Captain, will you kindly state your name and where you live?

Mr. SMITH. Alexander Smith.

Mr. MOORE. Where do you live?

Mr. SMITH. San Pedro.

Mr. MOORE. How long have you been on this coast?

Mr. SMITH. Twenty-seven years.

Mr. MOORE. What is your occupation?

Mr. SMITH. Master mariner.

Mr. MOORE. Have you been employed in San Pedro Bay or San Pedro Harbor in any diving operations or anything of that kind?

Mr. SMITH. I was engaged right off Point Firmin. I was master of the steamer *Whitelaw* in 1888.

Mr. MOORE. You are in charge of a wrecking outfit?

Mr. SMITH. I was then.

Mr. MOORE. What were you doing? Did you have anything to do with the wrecks on Point Firmin?

Mr. SMITH. Yes, sir; we wrecked a ship there in 1888 and early in 1889, the ship *Respigadera*.

Mr. MOORE. Did you notice anything at the time that indicated the direction of the current in one way or the other?

Mr. SMITH. Well, we worked there nearly the whole winter through, with the exception of two or three days, and no current ever stopped a diver from going down and working.

Mr. MOORE. You noticed no decided current then, as I understand it?

Mr. SMITH. No, sir; to prevent a diver from going down and working.

Mr. MOORE. Can you point out where that ship was wrecked, Captain, on the map?

Mr. SMITH. This picture is all one-sided. That ship was wrecked right off here, right under the light on the reef that bears southeast from Point Firmin [showing]. It was wrecked not over 500 yards from the beach. This reef bears southeast. It runs out a quarter of a mile, about.

Mr. MOORE. Do you know any facts, Captain, which show the direction of the current from San Pedro Bay?

Mr. SMITH. In 1887 I was towing mud out of San Pedro from the Southern Pacific dredger, and I believe it is the Los Angeles River, or San Gabriel as it is called, and the Government engineer made me put a buoy here to dump the mud; the buoy was put there and a few days after there was a gentleman came up from Long Beach and notified me not to dump any more mud because it was drifting down onto their resort, and I told him I had nothing to do with it, to go and see the Government engineer.

Mr. MOORE. Do you know anything else bearing on that matter?

Mr. SMITH. That shows the current goes to the eastward here. As I said before, our diver never refused to go down for a current right off Point Firmin.

Mr. MOORE. Did you ever have any experience at Redondo Beach, Captain?

Mr. SMITH. Yes, sir; I was four years master of a Redondo Beach towboat.

Mr. MOORE. What do you know of the character of the swells there?

Mr. SMITH. Well, the most of the wharf building is to the northwest. They built the Redondo Beach Wharf first, but they were not long in finding out they made their mistake in building their wharf southwest. I laid there for four years very comfortable, not any too comfortable in the outside wharf.

Mr. MOORE. Do you know anything about Port Los Angeles?

Mr. SMITH. I have anchored all around this bay. It looks better in the picture than it naturally is when you get there. The best anchorage I found was under the Dume Cove. I landed between six and seven hundred ton, it must have been in 1892, I think, and I very often had to leave there and come up under Point Cahuenga for shelter.

Mr. MOORE. That is called Kellers Shelter?

Mr. SMITH. Kellers Shelter. If it was properly drawn it would show the Santa Monica Mountains, the Saddle Mountain, but there is no good shelter there. I have laid on 45 fathoms of chain. There is a heavy undertow.

Mr. MOORE. How is it at Port Los Angeles?

Mr. SMITH. I anchored there in 1871. I was first officer of the schooner *Cora*, and the captain had an order to get some cargo from a Mexican up in the canyon. We laid there about thirty hours and got out of there.

Mr. MOORE. Why?

Mr. SMITH. We couldn't get ashore.

Mr. MOORE. What was the reason—too heavy a surf?

Mr. SMITH. Too heavy a surf, and we had to take off the cargo with just our common boats.

Mr. MOORE. How far out have vessels towed from Santa Monica?

Mr. SMITH. If you have to tow with a towboat, it would depend on the captain of the towboat—how the wind was before he left the vessel.

Mr. BURR. Captain, how do the swells at Redondo Beach compare with those at Port Los Angeles?

Mr. SMITH. Just about the same.

Mr. BURR. How do they compare with the swells off San Pedro?

Mr. SMITH. We do not have any swell there unless the wind hauls to the west and south. The reef that bears southeast from Point Firmin saves the swell from coming in there until you get outside of this reef, which is over a quarter of a mile. The reef is not pointed out here, but it ought to be shown. It is a great benefit, as any captain knows that anchors there.

Mr. BURR. Do the southeast winds raise much of a sea at San Pedro?

Mr. SMITH. Sometimes they do as long as they last. They do not last very long, but if a man gets his anchor down in good shape there is very little danger of dragging ashore.

Mr. BURR. But still some ships have been dragged ashore there, have they not?

Mr. SMITH. Not through good seamanship?

Mr. BURR. In consequence of the southeast winds?

Mr. SMITH. Yes, sir; with a foul anchor.

Mr. BURR. In general throughout the season, from one season to another, would you say that the water off San Pedro is not heavier than it is either off Redondo or Port Los Angeles?

Mr. SMITH. It is comparatively smooth in San Pedro when it would be rough in either of the places.

The CHAIRMAN. You say when you anchored at Port Los Angeles you could not get ashore. You laid there a time and then came away?

Mr. SMITH. Yes, sir.

The CHAIRMAN. You were then trying to land on an open beach?

Mr. SMITH. Yes, sir; right in the canyon. That was in 1871.

The CHAIRMAN. Would you or would you not have had the same difficulty if you had tried to land on the open beach at San Pedro with southwesterly winds?

Mr. SMITH. No, sir; we are protected from the southwest winds at San Pedro.

The CHAIRMAN. Don't you get any sea in there with southwest winds?

Mr. SMITH. We get a little swell occasionally, but there is good anchorage at Point Firmin to get out of that swell.

The CHAIRMAN. If there was no severe current near Point Firmin, which way was the existing current, weak or strong, and at what time of the year?

Mr. SMITH. I never found but very little current there. We were wrecking there in the winter time, and, as I have said before, it never stopped the diver from going down; he never had any difficulty.

The CHAIRMAN. What little current there was, did it always set in the one direction?

Mr. SMITH. No, sir; it did not.

The CHAIRMAN. Sometimes one way and sometimes the other?

Mr. SMITH. Yes, sir.

The CHAIRMAN. Along the coast, east or west?

Mr. SMITH. Yes, sir; mostly set to the eastward.

The CHAIRMAN. The set depended on the wind?

Mr. SMITH. A great deal. It might set up sometimes a little to the westward, but you get up into the channel and it sets eastward.

The CHAIRMAN. We are speaking particularly of the inshore current. The main current outside the headlands is generally to the southward?

Mr. SMITH. Sometimes it would be the other way.

The CHAIRMAN. As a rule it is mainly to the southward with the prevailing winds?

Mr. SMITH. I have steered across the channel a good many times, and you can never strike the same point by steering a straight course. Very few ever do it. I have never done it, and I have crossed there a good many times.

Mr. CORTHELL. In how strong a current can a diver work? How many knots current, as you have put it?

Mr. SMITH. Don't need many.

Mr. CORTHELL. How many?

Mr. SMITH. Less than two. That is giving you a limit each side.

Mr. CORTHELL. Have you commanded vessels?

Mr. SMITH. Yes, sir.

Mr. CORTHELL. How large vessels?

Mr. SMITH. The largest one was the Pacific Coast wrecker *Whitelaw*.

Mr. CORTHELL. What was the tonnage?

Mr. SMITH. Three hundred and fifty.

Mr. RODGERS. Have you been familiar with Redondo at all times of the year?

Mr. SMITH. Yes, sir. I was there four years steady, every day and night.

Mr. RODGERS. How is the southeast swell? What is the effect of the southeast wind at Redondo?

Mr. SMITH. It is not any too comfortable. It blows at any time. But to look at this map it looks very comfortable. And a southwest swell comes in that makes it very uncomfortable; in Santa Monica Bay always there.

Mr. RODGERS. You mean with a southeast wind the swell comes from the southwest?

Mr. SMITH. Yes; always along this coast. I laid there about four years ago, when the tide came down the beach and scooped out the middle of the wharf. There was no heavy sea on that night. The wind commenced to blow about 10.30, but there was no sea to wash down the wharf. But I sounded on the afternoon previous to that and it sounded about 20 or 30 feet, and the next morning the tide came along and scooped out the center of the wharf. I don't know how it was done. The piles all came ashore in good order.

Mr. RODGERS. There is a piece of old wharf still remaining, as I understand it, at Redondo? The shore end of the old wharf is still remaining?

Mr. SMITH. Do you mean the first wharf that they had there?

The CHAIRMAN. How was the wind at the time that tide rip took away the wharf; northwesterly?

Mr. SMITH. Yes, sir.

Mr. MORISON. How is Redondo in a northwest wind?

Mr. SMITH. In a northwest wind—we very seldom have that here. Along in the night—

Mr. MORISON. Supposing you did have them?

Mr. SMITH. We have them smooth; that is, not any smoother with the northwest wind than they have on the other wharf with a southeaster, because naturally the swell is not going to decrease between these two places. It is going to increase, if anything, and when it blows in either of the places there is no vessel that can work anyways comfortably. Of course, the larger the ship the better it can work.

Mr. MORGAN. I understood you to say that you had anchored in various parts of the Santa Monica Bay while you were in command of a vessel.

Mr. SMITH. I have, sir.

Mr. MORGAN. Will you please indicate on the map with the pointer there, as near as you may be able to do so, some of the places that you have anchored there?

Mr. SMITH. I have anchored in the Dume Cove here. I have anchored under Kellers Shelter. I have anchored right down here [showing] with a broken-down engine.

Mr. MORGAN. Just tell me where you anchored, please; that is what I want to get at.

Mr. SMITH. Why I anchored?

Mr. MORGAN. No; not why, but where else did you anchor than those places you have named?

Mr. SMITH. I have anchored near the canyon; I have anchored along here at the wharf.

Mr. MORGAN. Anywhere else?

Mr. SMITH. Yes, sir; I have anchored along here; taken up oysters from here all up the coast.

Mr. MORGAN. Have you remained there over night at anchor?

Mr. SMITH. Yes, sir.

Mr. MORGAN. Now I want to ask you in respect to the wrecks that occurred at San Pedro. You spoke of being familiar somewhat with the wrecks that took place at San Pedro to vessels that were wrecked there. I understood you rightly, didn't I?

Mr. SMITH. Yes, sir.

Mr. MORGAN. And as I understood your answer, it was that these wrecks were due to bad seamanship?

Mr. SMITH. Yes, sir; two-thirds of them. I said so; yes.

Mr. MORGAN. Foul anchor?

Mr. SMITH. Yes, sir.

Mr. MORGAN. In how many instances was it a foul anchor?

Mr. SMITH. There was one wreck, the *Kennebec*, it don't show here. I don't know as you could call it a wreck. He thumped on a ledge of rocks, and a bell buoy was afterwards put on here.

Mr. MORGAN. What I want to get at is this: Do you know yourself of a vessel that was wrecked there on account of a foul anchor?

Mr. SMITH. The *Kennebec* dragged her anchor when it was fouled.

Mr. MORGAN. Did you see the anchor?

Mr. SMITH. No; but the man that picked them up told me so.

Mr. MORGAN. Was there any more than one that was wrecked on that account?

Mr. SMITH. Well, the ship *America*—I didn't see whether its anchor was foul or not. There was nobody aboard the ship, only the custom-house officer and the first officer, and the man let go the line anchor trying to save the ship, whereas, if he had let it go before he would have shot right into the entrance of San Pedro instead of going broadside onto it.

Mr. MORGAN. Do you know of any other one?

Mr. SMITH. The *San Luis*; she was anchored here too.

Mr. MORGAN. You saw her, did you?

Mr. SMITH. I saw her when she was in pieces.

Mr. MORGAN. You did not see her until she was a wreck?

Mr. SMITH. No, sir; I was at sea that night.

Mr. MORGAN. Then your statement in respect to bad seamanship is a general statement? It is not intended that this Board should understand you that you have investigated the question of seamanship as applied to these disasters?

Mr. SMITH. If the captains had been aboard their ships, which they were not, with the exception of the *San Luis*—the captain was aboard her. The American ship *Kennebec* and the ship *America*—the captains were ashore instead of being aboard their ships.

The CHAIRMAN. That collier that you speak of, that was lost on the reef off Point Firmin; was she driven there by bad weather or by luffing around the point too close?

Mr. SMITH. He calculated to come around. He had been there several years before that.

The CHAIRMAN. He hugged the point too close?

Mr. SMITH. Well, I was aboard in half an hour or an hour after, and he said he wanted to round it on the starboard tack. There is not a vessel in a thousand that ever came into San Pedro that will round on the starboard tack—that is, by making a luff around that way. If you have a good prevailing summer wind, it is as easy as falling off a log to fetch a ship around to head under wind.

The CHAIRMAN. He was not put ashore by the bad weather?

Mr. SMITH. No, sir; by no means. It was a clear day, with a fair wind.

Mr. FRANCIS. Mr. Chairman, we would like to present Mr. Jones as our next witness.

Mr. MOORE. What is your name?

Mr. JONES. Joseph S. Jones.

Mr. MOORE. What is your occupation?

Mr. JONES. Wood and coal dealer.

Mr. MOORE. Tell what you know, if anything, about coal washing from Point Firmin, or from San Pedro Bay?

Mr. JONES. I know ever since I have been there up until the last two or three years, that there has always been a great deal of coal picked up along the beach, all the way from the mouth of the San Gabriel River down as far as Alamitos Beach, and during the time of those wrecks, as a matter of course, there was a great deal more coal gathered up than at any other time since I have been there. There were two or three men there that gathered up great quantities of it. Some families there gathered up enough to last them all winter, some more than they needed, and sold to other parties. And I know it affected my coal trade for quite a little while afterwards—I don't remember just how long, a few days probably after that—very much. That is about the extent of my observation in regard to those currents.

Mr. CORTHELL. Mr. Jones, have you ever seen coal floating on the current there at Long Beach?

Mr. JONES. No, sir; not exactly floating. I have seen it rolling and tumbling on the bottom where it was rolled in by the action of the waves.

Mr. CORTHELL. Have you any idea how strong a current it would require to move coal in a current?

Mr. JONES. Well, I can not say that I have. I have very little knowledge of water. I was raised entirely off water, and have never been about water, and do not pretend to know anything at all about water currents.

Mr. CORTHELL. The reason I asked the question of you is, I understood you to testify to the point in reference to a current along the coast, and this coal is found on the beach—

Mr. JONES. Yes, sir.

Mr. CORTHELL. Above the water?

Mr. JONES. Yes, sir; sometimes clear up on the beach.

Mr. CORTHELL. Now, to your knowledge is it moved by any current?

Mr. JONES. There is something that moves it there; and I have seen it in the water rolling back and forth just as anything does.

Mr. CORTHELL. Could it possibly have been the waves that moved the coal?

Mr. JONES. Well, as I said before, I am not well enough posted in regard to water to know whether you might call it current or waves. There was some force that brought it in, evidently.

Mr. CORTHELL. Have you any knowledge of any coal being thrown into San Pedro Bay near Timms Point before the jetties were built?

Mr. JONES. No; I have not.

Mr. CORTHELL. Well, at any time after the jetties were built, or before, to your knowledge; and how much coal?

Mr. JONES. Do you mean inside of the bay proper—inside of Deadmans Island?

Mr. CORTHELL. In the vicinity of Timms Point, where the colliers used to unload.

Mr. JONES. I remember that there were ships wrecked there a few years ago, so they said. I wasn't over to see them myself.

Mr. CORTHELL. Do you remember about this ship that has been testified to, *Respigadera*, or some Spanish name?

Mr. JONES. Yes; I can remember about that.

Mr. CORTHELL. Where did most of that coal wash ashore?

Mr. JONES. As near as I understand it, the most of it washed ashore in San Pedro Bay or up near Timms Point. The greater portion of it washed ashore there.

Mr. FRANCIS. Our next witness will be Mr. J. W. Davis.

Mr. MOORE. What is your name?

Mr. DAVIS. J. W. Davis.

Mr. MOORE. Where do you live?

Mr. DAVIS. I live at San Pedro.

Mr. MOORE. What is your occupation?

Mr. DAVIS. I am agent for the Ship Owners' Association of the Pacific Coast.

Mr. MOORE. Have you had any experience in Santa Monica Bay, going over there with men, or anything of that sort?

Mr. DAVIS. Somewhat; yes, sir.

Mr. MOORE. At Port Los Angeles?

Mr. DAVIS. Yes, sir.

Mr. MOORE. What is the difficulty, if any, in handling ships there?

Mr. DAVIS. I am not a shipmaster. I haven't anything in that line. I am not a shipmaster at all, and don't know anything about the handling of ships.

Mr. MOORE. How about loading and unloading?

Mr. DAVIS. My experience has not been along the line of loading or unloading. The experience I have had with vessels at Port Los Angeles and San Pedro has been along the line of furnishing crews to vessels. The particular matter, I suppose, that you are trying to get at is in regard to an experience I had something near a year ago in Port Los Angeles in attempting to get a crew to the ship or bark *Fernbank*. I had an engagement to deliver a crew there at a certain time. The arrangement was, I was to deliver the crew by water. I started the crew from San Pedro all right, and the water was all smooth and nice. We had no trouble until we got outside; then there was a good deal of battling with the waves. The man that was delivering my men succeeded in getting within two or three miles of Port Los Angeles, but the sea was so stormy that it became necessary to put back, and he got back into San Pedro between 4 and 5 o'clock in the morning. The crew had to beat Santa Monica or Port Los Angeles by the next afternoon, so I waited until toward noon and took the midday train, taking my men to Port Los Angeles by rail. When I got to Santa Monica I met Captain Dornfeld and the captain of the vessel. I notified them that I had my men there, and they replied that it would be impossible to take the men to the vessel; that the seas were running so high that men could not be put on the vessel, and that I would have to take care of them otherwise. I asked them why, if such was the case, that they hadn't telegraphed to me, notifying me that those men could not be put on board, that I might have kept them until such time as we could get them on. Captain Dornfeld's answer to me was that the sea was so rough there that they supposed it would be rough enough at San Pedro that I wouldn't attempt to take my men over. I explained to him that we had started with the men the night before, and after spending the night on the water with them, and finding it impossible to get to Port Los Angeles, that we had returned, and that we had waited in San Pedro all the forenoon in anticipation that a telegram might come to me, and having received none, my crew being time goods, I felt called upon to take the train and take them over there. I insisted, if it were possible, that I put my men aboard the vessel, because, as I explained to them, the men had got to drinking,

and there was considerable dissatisfaction among them. Captain Dornfeld responded that it would be sheer folly to put a crew on board the vessel from the wharf; that no boat could live in such a sea as was then running. He instructed me to take the men to the end of the wharf and we would be made as comfortable as it would be possible for them to make it. They went down there, and my men very soon admitted that they didn't want to try that sea in such a storm as that. We kept our men there all night, and by something like 10 or 11 o'clock the next day the sea had calmed so we could get our men to the vessel, which was anchored something like a quarter or half a mile from the end of the wharf.

Mr. MORISON. What kind of a craft did you bring your men from San Pedro in?

Mr. DAVIS. The boat that we had to take them in from San Pedro was a sloop about 25 to 30 feet long—about 30 feet long, I think. I will say that I didn't go with the men on the water. The man who took my men when they went by water is here. I started them by water and I was to go over the next day. They started out in the evening and battled with the waves all night.

Mr. MORISON. When was this?

Mr. DAVIS. I don't know just when it was. I should say it was about March or April of this year. The waves were running high—about 10 feet high, it appeared to me—and splashed pretty badly at Port Los Angeles.

The CHAIRMAN. What was the direction of the wind?

Mr. DAVIS. I can't give you the direction exactly, but standing on the end of the wharf, as I remember, the wind would be coming in in such a way that the direct line of the wind toward us would be to the left of Point Dume. It seemed to be coming straight in, say, west, or probably a little north of west—somewhere along in that line.

The CHAIRMAN. Just turn around and look at the chart, Captain. You will see where the north point crosses the west point at right angles to it.

Mr. DAVIS. Well, standing at the end of the wharf, as I noticed the wind, I would say the wind would be coming about like this [indicating]—coming toward us in such a way as to miss Point Dume somewhat.

The CHAIRMAN. Did it come in clear of Point Dume?

Mr. DAVIS. I remember that that matter was discussed in our conversation, and I would state, without anything as a wind gauge, that the wind just about missed Point Dume.

The CHAIRMAN. You see that arrow above where the proposed breakwater is? Was it in the direction that arrow is drawn, or nearer Point Dume than that?

Mr. DAVIS. I should say it was nearer Point Dume than that. I have been at Port Los Angeles a number of times in handling men, and this was the roughest sea I have ever seen there. I have been there probably twenty times in all.

The CHAIRMAN. Did you ever have trouble there at any other time?

Mr. DAVIS. Yes, somewhat. We had some trouble a little later; I should say it was in May of this year. It was not serious trouble. We had rather a serious experience with the ship's boat of the ship *Charles E. Moody* in getting ashore. In the morning when we put the crew on it was pretty rough. We had some rough experience in getting the men on board, but about 3 or 4 o'clock in the afternoon, when we attempted to get ashore, it was pretty severe. The waves seemed inclined to roll over us pretty badly, and filled the ship's boat, I should say, half full of water. We were all thoroughly drenched, and the captain said it was a very severe storm; in fact, before leaving the vessel, he said that if it was not a matter of necessity, in most, that he would not be inclined to take us ashore.

Mr. MORISON. When you put that first crew on board how far from the wharf did the ship lie?

Mr. DAVIS. In all those cases where I have put crews on board, where the vessel was not at the wharf, as in the case of the *Fernbank* and the *Charles E. Moody*, I should say that the vessel stood off somewhere between a quarter and half a mile. That is a landman's guess at distance over water.

Mr. MORISON. Did they have any difficulty in riding at anchor there?

Mr. DAVIS. Not that I know of. I am not experienced about that. The vessel didn't drag.

Mr. HOOD. I would like to ask about this matter. How large a ship was this one which you tried to put the men, first by boat from San Pedro, and second from the wharf? What ship was it, and how large was she?

Mr. DAVIS. It was the *Fernbank*. I don't know her size.

Mr. HOOD. About how large?

Mr. DAVIS. I think she had something like 2,500 tons of merchandise when she came here. She was not as large a vessel as the *Moody*.

Mr. HOOD. It was a heavy sea?

Mr. DAVIS. The *Fernbank* occasion was the heaviest sea, I think, I ever saw anywhere.

Mr. HOOD. Did she drag her anchors dangerously close to the shore?

Mr. DAVIS. I don't think she dragged her anchors at all. I am not sure whether she was anchored or attached to the buoys.

Mr. HOOD. She was anchored to something?

Mr. DAVIS. She was anchored to something, evidently.

Mr. HOOD. Did the captain meet you when you went to the wharf finally with your men—the captain of the *Fernbank*—and speak to you at all on the wharf?

Mr. DAVIS. When I went to the wharf?

Mr. HOOD. Yes; with the men.

Mr. DAVIS. I met the captain in Santa Monica on my way down to Port Los Angeles. I met the captain and Captain Dornfeld, and this conversation transpired there. They stayed there. I went on down to the end of the wharf, and I had my men sleep in the passenger depot there over night, and the captain of the *Fernbank* came down the next morning.

Mr. HOOD. You said you had a great deal of trouble with your men on shore, they being off duty and there being sundry temptations, so that they were likely to get in bad order.

Mr. DAVIS. No question about that. The men took to drinking, and when sailors get to drinking they are hard to handle. I was anxious to get my men on board that night, but Captain Dornfeld's expression was that it would be sheer folly to attempt to put the men on board that night, as no boat could live in that sea.

Mr. HOOD. Will you listen particularly to this question?

Mr. DAVIS. Yes, sir.

Mr. HOOD. Did not the captain of the *Fernbank* refuse to take the men aboard in the condition they were then in?

Mr. DAVIS. No, sir; he did not.

Mr. HOOD. Remember you have said that.

Mr. DAVIS. I said it.

Mr. MORGAN. I understood you made up this crew in San Pedro.

Mr. DAVIS. Yes, sir. My place is in San Pedro, and I furnish crews for vessels from Santa Barbara down.

Mr. MORGAN. The crew sailed out in a boat 35 feet long?

Mr. DAVIS. They left San Pedro. I don't think the boat was over 30 feet long. I don't remember exactly.

Mr. MORGAN. Well, 30 or 35 feet long. Sailed out around San Pedro and into Santa Monica Bay during this storm?

Mr. DAVIS. Yes, sir; sailed out of San Pedro along in the evening, expecting to reach Santa Monica the next morning. There was no storm at San Pedro; nothing to indicate to me that there was any storm anywhere.

Mr. MORGAN. Then the storm came on afterwards; I didn't quite understand that.

Mr. DAVIS. When the boat came back there was still no storm at San Pedro, and during the day when I went over to Port Los Angeles there was still no storm at San Pedro; that is, nothing to make any waves.

Mr. MORGAN. There was a wind blowing there, I suppose?

Mr. DAVIS. I think not an extraordinary wind; I think there was the ordinary wind. I think the ordinary west wind was blowing.

Mr. MORGAN. What I wanted to get in my mind was the practicability of going around into Santa Monica Bay in the night in a storm in a boat 30 feet long loaded with men.

Mr. DAVIS. The man who took the men is here, and he is a practical seaman, and he can explain that.

Mr. MORGAN. Of course, that is a matter of some interest. The action of a storm at sea is of interest, and I want to understand that accurately—that they came out in the evening from San Pedro and sailed around into Santa Monica Bay and were there during this storm seeking to be received on board of this ship.

Mr. DAVIS. No, sir; they never got within 2 miles of the vessel. Mr. Winther, the man who was taking them, is here.

Mr. MORGAN. Then did they come ashore?

Mr. DAVIS. No, sir; they came back to San Pedro.

Mr. MORGAN. They sailed back in this storm to San Pedro?

Mr. DAVIS. Yes, sir; and the next day I took them over by rail.

Mr. BURR. How long did you state you had been engaged in this business?

Mr. DAVIS. Four years, nearly.

Mr. BURR. During that time have you ever had any trouble in putting crews aboard ships in San Pedro Bay—any trouble similar to that you have experienced at Santa Monica?

Mr. DAVIS. Trouble from the elements?

Mr. BURR. Yes.

Mr. DAVIS. No, sir. However, most of the men we put on board in San Pedro we put on in the inner harbor. I have put on a dozen or more outside. I never have any trouble at all. I had some little trouble once in getting men into a boat, some-

thing the same size as I used at this time, at Long Beach. At the time the strike was the worst I attempted to evade the union sailors by taking a crew to Long Beach and embarking there and taking them out to the vessel that was at anchor. I had some rather serious trouble at Long Beach, but we didn't drown anybody. I never had trouble in putting men on in San Pedro outer harbor.

Mr. FRANCIS. With your permission, we will call Mr. Winther.

Mr. MOORE. Where do you live?

Mr. WINTHER. San Pedro.

Mr. MOORE. What is your occupation?

Mr. WINTHER. Seaman.

Mr. MOORE. Please tell your experience in trying to take men around to the *Fern-bank*, of which the last witness has spoken.

Mr. WINTHER. I left San Pedro in the afternoon, I should judge about 2 o'clock. My idea was to take advantage of the northwest winds in the afternoon. I wanted to have the mild weather at night, because the wind generally dies down along about sundown. As I got up beyond Point Vincente, the sea was increasing somewhat, and the wind was westerly. The wind was increasing somewhat, and I put a reef in the sail. Beyond Point Vincente I found considerable sea, but nothing that I thought anything of. I had only a single reef in the sail. As I stood along into the Bay of Santa Monica the sea became very much heavier, and I knew from experience, being a practical seaman, that it would be impossible for me to make a landing at Santa Monica. It would not do to go alongside a vessel in that sea with a boat, and I knew I couldn't land at the wharf, so I went back to San Pedro again. However, the only thing that will illustrate this case is this: In running back to San Pedro, after rounding Point Firmin, we didn't have any sea at all. I was surprised to find the bay at San Pedro so smooth after finding such a sea at Santa Monica Bay.

The CHAIRMAN. How far into the bay of Santa Monica did you get? You spoke of Point Vincente.

Mr. WINTHER. We came out by Point Vincente here, and I got up perhaps this far in the bay [indicating halfway]; I should judge, some 6 or 7 miles.

Mr. MORISON. Up to Point Bollona?

Mr. WINTHER. Not so far in. The wind being west-northwest, I had a straight course for the wharf, and I got about this far [indicating halfway]. In the night I couldn't tell within a mile or two where I was.

The CHAIRMAN. Was the wind increasing as well as the sea?

Mr. WINTHER. The wind and sea were increasing. In running back, instead of reefing the sail I dropped the peak until I reached San Pedro Bay, where I could carry my full sail.

The CHAIRMAN. With that wind, after you had rounded Point Firmin, you ran into smooth water and were protected by that high land?

Mr. WINTHER. We were protected by the high land. The sea is always heavier in Santa Monica Bay. At Point Vincente you will always find a heavy sea, but when the wind is blowing northwest or west after the sea runs regular with the channel both wind and sea will turn and roll in. The current always sets in. It will circle around the point and run in. It will have an effect upon the sea. I have laid at Santa Monica when it was dead calm, and it has been impossible to lie there simply from the swell. The tide sweeps in. I have sailed on the coast twenty-odd years, and if a vessel is becalmed here [indicating on map] she will naturally set in with the swell and tide. That is the danger to mariners in this bay. The tide and swell set you in. Also, in towing a vessel from here [indicating on map] no shipmaster will drop his towboat here unless he has a good breeze. He will not endanger himself by letting go a thousand-ton ship in here [showing], knowing that he is liable to lose the wind.

Mr. MORISON. How large a boat did you have to take these men around in?

Mr. WINTHER. She was a hired boat. I think she was 28 feet long, with a 10-foot beam, sloop rigged.

Mr. MORISON. Was she decked over?

Mr. WINTHER. Yes, sir; decked over, with a cabin.

Mr. MORISON. How many men were on board?

Mr. WINTHER. If I remember right, it was 11. I am not positive what number. It may have been 13, and may have been 15.

Mr. MOORE. This man knows something about the *Respigadera*.

The CHAIRMAN. You say it is necessary to tow a long distance at Santa Monica in order to get in the breeze outside?

Mr. WINTHER. Yes, sir. I don't mean to say the breeze never stands in here, but I do mean to say that it leaves you here much earlier than it does in the channel.

The CHAIRMAN. What is the reason for losing the breeze in there?

Mr. WINTHER. I couldn't tell you; but nearly every seafaring man knows that in the bay you are apt to lose the breezes.

The CHAIRMAN. Of course, there is a cause for it?

Mr. WINTHER. The lands and high hills. You might sometimes have a gale of wind in there when there is nothing outside. In regard to the *San Luis* at San Pedro, the *San Luis* never laid at anchor. The *San Luis*, along with a number of others, hove anchor and intended to make sail and make the open sea, because San Pedro is not safe in a southeaster no more than any other open port. They slipped their anchors and made sail to go to sea. Two of the other vessels stood off on a long tack toward Newport, and on the next tack got clear of Point Firmin. The *San Luis* was one of those old Government vessels—ninety-day gunboats—long, narrow things, and didn't handle well. She was barkentine rigged and refused to tack. They tried to enter into the inner harbor of San Pedro, but she being so long they couldn't make it, and she ran into the cove just the other side of the channel. She was lost on account of not being able to handle the vessel. She wouldn't handle well.

The CHAIRMAN. Captain, when you speak of going with those men to Port Los Angeles, what made you think that the waves at Port Los Angeles would be higher than those in the middle of the bay?

Mr. WINTHER. I didn't think they would be any higher. I expected to find them just the same, and I did the next morning. I had been there a number of times and was familiar with the bay. I knew with the sea I had out there I couldn't put a boat alongside of a vessel. My boat would tear to pieces or tear the mast out, or something like that.

The CHAIRMAN. With the wind from a direction that made it smooth at San Pedro, wouldn't you have a right to expect that as you drew in under that high land at Port Los Angeles it would be smooth in there?

Mr. WINTHER. No; because I knew from experience that it is not. The swells keep rolling in there. It does not at San Pedro, because the moment that you round Point Firmin here, this reef of rocks and this bed of kelp that runs out here about three-quarters of a mile [showing on map] break the sea, and you have smooth water. The only place in San Pedro where you will find swells is away down here [showing on map]. If you anchor up in here anywhere you don't have those swells [showing on map].

Mr. MOORE. Did you go with Mr. Davis when he went around by rail?

Mr. WINTHER. I did.

Mr. MOORE. Can you tell what happened then—what the captain said?

Mr. WINTHER. I didn't hear the conversation, but I had charge of the men. That is, I stayed with the men, and we had to sleep in the depot that night. The waves, I judge, were about 10 feet high. They were rolling pretty high. They were breaking up over the end of the wharf in spray. I don't want to be understood as saying that the waves rolled over the wharf, but the spray came over, and it made the building tremble. So we passed the remark that we wouldn't like to live out on that wharf the way it went. The vessel had also sustained some damage while lying at the wharf. Some of the chocks were torn out. The American ship *Moody* had her cat's head and side chocks torn out. I was on board of all the vessels, and stayed three or four days while there.

Mr. MORGAN. At the time you were sailing around from San Pedro to Santa Monica, and when you were centrally in Santa Monica Bay, what direction was the wind?

Mr. WINTHER. When the wind first began to breeze up a little it was westerly, and it hauled into about west-northwest.

Mr. MORGAN. It was about that direction before you turned around to return?

Mr. WINTHER. When I turned around I found the wind about that direction, gradually hauling to the northward.

Mr. MORGAN. You are familiar with Santa Monica Bay and have sailed through all parts of it?

Mr. WINTHER. In small boats and coasting vessels, yes.

Mr. MORGAN. With the wind west-northwest, would or would not these places that have been testified to back of Point Dume and over there in the bay furnish a shelter?

Mr. WINTHER. If I would want to go back of Point Dume, I could find shelter for anchorage, but I would not know how long I would have to lie there before I could deliver the men. I had only lunch enough for one meal, expecting to make the place in six hours. The men were to be delivered at a certain time. The only way I could deliver them in that time was to run back to San Pedro and take the train.

Mr. MORGAN. I wanted to know the fact, because, without knowing entirely, it occurred to me you might have sailed in there with your men.

Mr. WINTHER. I could have sailed in there; no question about that.

Mr. MORGAN. Your explanation is entirely satisfactory.

The CHAIRMAN. Did you have any trouble with the boat you were in, the wind being west-northwest and the waves 10 feet high, when you ran back to San Pedro from your position in Santa Monica Bay?

Mr. WINTHER. No; I had no trouble with the boat at all. The boat behaved very

well. She was taking some water, but she was closed up. When I say I had no trouble, I mean there never was any time when I was afraid of our lives. Of course, we were drenched.

Mr. FRANCIS. We desire to present a gentleman very prominent in our commercial affairs and at present the president of our Chamber of Commerce.

Mr. W. C. PATTERSON, president of the Los Angeles Chamber of Commerce, spoke as follows:

Mr. Chairman and gentlemen, since the beginning of this controversy, with reference to the establishment of a harbor contiguous to Los Angeles, I have been more or less deeply interested, and have even taken the time to leave my business and make two trips to Washington in its interest. I want to say, though, as I have said on other occasions, both in public print and otherwise, that so far as I am concerned there is no personal feeling toward the Southern Pacific Railway. In my somewhat extensive business relations with that company I have at all times been treated with courtesy and consideration. I think it is only proper that I should say this preliminary to what I shall further say.

I appear before you as a business man, engaged in a business which now involves a large amount of shipping and which is capable of expansion. I also appear as a representative of the Free Harbor League, an organization composed of a large number of our most prominent and active business and professional men. The league was organized for the purpose of securing the construction of a deep-water harbor which would be accessible to as many railways as may wish to come to the water front. It was the belief that only such a harbor would best subserve the interests of this great and growing community, and at the same time be of incalculable benefit to transcontinental commerce.

I am not informed as to whether the desires of our citizens will be a factor in the determination of the problem which you are to solve, but I confidently assure you that there is practically but one sentiment among the people who are engaged in active business enterprises in this community, and that sentiment is in favor of San Pedro.

I desire to file with you a document which expresses the desires of those whose opinions we, who know them, believe to be entitled to great consideration. The signatures are of those who comprise practically every commercial interest in this community. Among these are representatives of every bank in this city save one, and that bank had a satisfactory reason for not uniting with the others in this matter. The ratings, as shown by the commercial agencies, show that those engaged in active commercial enterprises who have signed this document represent an aggregate capital of about \$15,000,000. The petition is as follows:

"DECEMBER, 1896.

"To the Harbor Commission:

"The undersigned business men and property owners of Los Angeles and vicinity beg to assure you of their belief that unless serious technical reasons to the contrary should intervene the commercial interests of this section will be best subserved by the selection of San Pedro as the location for the Los Angeles Harbor, for the reason that at San Pedro the harbor will be free to all railways that may desire to enter, an advantage that can not be enjoyed at any other point now under discussion.

"As proof of the sincerity of our position in this matter, we desire to state that we who sign this petition have not and will not sign any petition addressed to your Board in favor of any other locality than San Pedro."

A similar document is here presented, signed by business men and citizens of Redlands, and business men and citizens of Pomona.

The strong and overwhelming sentiment in favor of San Pedro must be due to the fact that there exists in the minds of a multitude of men strong reasons, gained by experience, and their knowledge of the business of this section of the country.

Whatever may be said by way of theory, the common-sense people of Los Angeles believe that the only harbor approachable on all sides is the harbor at San Pedro. It may be approached at right angles, where other railroads can be built across any road which may now or hereafter align the outer harbor frontage, and so reach the area of the outer harbor.

The people of Los Angeles believe that it would be of great advantage that a harbor should be constructed at such a locality, in preference to one which may be subject to the control and domination of any corporation or corporations which chance to have the right of way. It has been suggested to me that the regulations of the municipality of Santa Monica can protect the absolute use of approach to a harbor in that vicinity, and embarrass, if not prohibit, any other railroad which may desire to enter. It has been admitted, if I am not mistaken, that a very large portion of the front of the area of land contiguous to Port Los Angeles is owned by a person closely connected with the railroad company which now occupies the entrance to Port Los Angeles. It is possible that this fact would furnish opportunity for discrimination and for burdensome exaction upon the commerce intended to be served

through the harbor. I do not attempt to say that such discrimination would be made, but I can conceive of conditions under which it could be made to an extent well-nigh intolerable.

In order to accommodate commerce it is necessary that a harbor should be large and easy of access. It should supply facilities for the construction of warehouses where merchandise to be shipped may be stored pending the arrival of bottoms in which it is to be shipped, and where freight unloading may be stored for distribution and for future handling, without the necessity of at once rushing it from the point where it is unloaded. In addition to this, the cost and opportunities for private ownership of wharves and warehouses at the harbor are of very great importance. It has been stated by parties connected with the wharf at Port Los Angeles that that great work cost something near \$1,000,000. This statement has been confirmed by a letter from Mr. Huntington to the Secretary of War, to which letter reference has already been made to your honorable Board. Whatever its cost may have been, it would be folly to say that any commerce can be done to-day at Port Los Angeles, or can be done in future, except it be over a wharf extending a long distance from the shore. Such a wharf at best is very costly to construct under the peculiar conditions affecting wharf piling on this coast. So costly, indeed, must the structures be, even under the protecting conditions of a breakwater, that the idea of private ownership is forbidden and the real ownership and control of wharves at that locality must of necessity be in the hands of large and wealthy corporations.

I do not believe that a proper harbor for commerce can be created where the wharves and their surroundings are confined to any one corporation, whatever may be its name. Our people have hoped that the Government would afford such a harbor upon this coast as will attract to it a class of commerce now going to more southern ports, namely, the commerce of the Orient. Such a commerce would find at a proper harbor constructed for Los Angeles two or more lines of railway which would carry it to the Eastern States over lines of easier grades and with less interference during the winter storms. No better place can be found on the western coast of America for the establishment of such a harbor than at San Pedro.

It appears to me that the ships which bring freight over thousands of miles of stormy seas must have offered to them by the harbor to which they are destined opportunities for refitting and recovering themselves from the damages and injuries incident to long voyage. This essential feature can not exist at Port Los Angeles. At San Pedro the opportunities for the proper construction of docks are abundant. These conditions will exist to a still greater extent when the project, submitted by Colonel Benyard and approved by the Government for obtaining an additional depth of 4 feet over the bar, making a total depth of 24 feet at high tide, has been carried out.

A very strong recommendation for the location of the outer harbor at San Pedro is the fact that the Government has at that point expended \$1,000,000 in the development of an inner harbor, which it will no doubt continue to maintain and improve. A harbor at Santa Monica would necessitate the maintenance of two harbors instead of one. The Government would necessarily have to care for and maintain two different projects, whereas, if the outer and inner harbors are both established at San Pedro, both can be cared for under the same appropriation and under the same management. To me it seems that it is beyond dispute that an outer harbor can be constructed more cheaply and can be utilized more fully and more satisfactorily at San Pedro than can any harbor located at Port Los Angeles.

I would say, in conclusion, that the business community of Los Angeles, whom I represent, is, in its opinion, entirely in accord with the conclusions reached by the Board of Engineers of 1892 as to the proper place for the establishment of a harbor for the future developments of trade on this coast. We believe that the Nicaragua Canal will be constructed. We believe that when the canal is constructed the larger portion of the commerce which this harbor will be called upon to take care of will come from the eastern coast, and will find its first distributing point at the locality which this Board shall select, providing that it is one which will accommodate that commerce.

Mr. HOOD. May I ask a question or two?

The CHAIRMAN. Do you want to ask anything, Mr. Moore?

Mr. MOORE. No, sir.

The CHAIRMAN. Go ahead, Mr. Hood.

Mr. HOOD. I think I understood you to say, when you read the petition signed by the business men (you omitted to read their names, but that is very satisfactory, as we can read them afterwards), that they had not and would not sign any other petition. Will you kindly read that sentence again, that I may have it accurately?

Mr. PATTERSON (reading). "As proof of the sincerity of our position in this matter, we desire to state that we who sign this petition have not and will not sign any petition addressed to your Board in favor of any other locality than San Pedro."

Mr. HOOD. That is the exact wording of it?

Mr. PATTERSON. Yes, sir.

Mr. HOOD. Now, I would like to ask you in reference to another matter. How long is the proposed breakwater at Port Los Angeles, as proposed in the last document of the Army Engineers, Document No. 41? Have you ever studied that subject?

Mr. PATTERSON. I have not, so as to be able to give any idea as to the length.

Mr. HOOD. Have you any idea?

Mr. PATTERSON. As to the questions of dimensions and all those matters, I have assumed that they were simply scientific matters and I am not able to answer that.

Mr. HOOD. You made a statement which directly affects the question and would indicate that you knew how long it was. Therefore, I take the liberty of asking the question. I think I understood you to state that a person closely connected with the railroad owned certain property. By that person, I understand you mean Mr. C. P. Huntington.

Mr. PATTERSON. Yes, sir.

Mr. HOOD. We have not tried to conceal that point, but have volunteered it. I understood you to say that the land owned included a large part of the protected frontage. Will you kindly say if I misunderstood you.

Mr. PATTERSON. I understood that it had been admitted here that the land was so owned. I was not present at the time.

Mr. HOOD. It was not admitted; it was so stated.

Mr. PATTERSON. Then I accept the correction. I was not present.

Mr. HOOD. What I am after is this: Do you say it covers a large part of the protected frontage of the proposed breakwater?

Mr. PATTERSON. I said a large portion; yes, sir.

Mr. HOOD. Do you know for how great a distance this piece of land fronts on the shore?

Mr. PATTERSON. No, sir; I don't know that I do.

Mr. HOOD. Have you any idea how far?

Mr. PATTERSON. It seems to be considered as a matter of general information.

Mr. HOOD. By yourself?

Mr. PATTERSON. Talked of generally by our citizens.

Mr. HOOD. Has it been so considered by yourself or have you heard it so stated?

Mr. PATTERSON. As to that, I simply take the statements of gentlemen that I assumed knew about it. I have never measured it and never looked up the record.

Mr. HOOD. Then you have no idea whatever as to the length it fronts on the shore? You don't know the length of the proposed breakwater and you don't know the length of this property on the shore; whether it is half a mile, quarter of a mile, an eighth of a mile, or what distance?

Mr. PATTERSON. No, sir; I do not.

Mr. HOOD. You don't know anything about it?

Mr. PATTERSON. I have never looked up the records to know anything definitely about it. Those are matters which I presume can be proved or disproved as the facts may justify.

Mr. HOOD. Then your statement that it was a large part was founded upon no definite knowledge whatever?

Mr. PATTERSON. Not from my own measurements at all, but from statements that I was inclined to accredit.

Mr. HOOD. I just wish to have it clear, because I don't wish to do you any injustice; but I want to know if it is a general impression you have, or whether you know anything about the matter of your own knowledge.

Mr. PATTERSON. I have never looked up the records.

Mr. HOOD. It is quite clearly shown in our testimony. I would like to ask another question. Do you know whether this same land that we are speaking of is at the easterly or westerly end of the proposed protected foreshore?

Mr. PATTERSON. No, sir; I do not.

Mr. HOOD. If it were at the westerly end, do you think it would be as much of an obstruction to the entrance of other roads as if it were at the easterly end?

Mr. PATTERSON. My impression is that the great obstruction in the matter of warehouses, and so forth, is the very high bluff.

Mr. HOOD. I am not asking about that. You don't know whether it is at the easterly or westerly end of the proposed breakwater, or opposite the proposed breakwater?

Mr. PATTERSON. I don't know its exact location.

Mr. HOOD. Now, in regard to another matter. I understood you to say (and this is subject to correction) or to imply, perhaps, that at the San Pedro outer harbor there were very much better facilities for repair docks and wharves; in fact, you used some very general terms with reference to those matters—with reference to the superior advantages for repair docks at San Pedro outer harbor.

Mr. PATTERSON. That statement was not meant to apply simply to the outer harbor, but to the entire project there.

Mr. HOOD. Then you meant there were excellent opportunities for making repair docks in the inner harbor at San Pedro for repairing vessels which could get into the inner harbor?

Mr. PATTERSON. And also at the wharves at the outer harbor.

Mr. HOOD. Then you only propose to repair at San Pedro light-draft vessels?

Mr. PATTERSON. Such vessels as could get into these docks.

Mr. HOOD. You don't mean to say that on that rock cliff or foreshore, which is very well known to you, that there are superior advantages for the construction of such improvements?

Mr. PATTERSON. Not for docks at that point; no, sir. In referring to the question of docks and wharves, I referred to the entire project, both the outer and inner harbors.

Mr. HOOD. Then any facilities for repairing in the inner harbor at San Pedro, in its present condition, or any condition, would be for ships that you could get inside of the inner harbor?

Mr. PATTERSON. That is probably true.

Mr. HOOD. I wanted to know if you meant that.

Mr. PATTERSON. At the same time, under the Benyaard project, or any other projects that may be adopted, deeper-draft vessels still can go in.

Mr. HOOD. Now, you said, did you not, that the outer harbor presented cheaper sites for the construction of wharves for receiving deep-draft ships than did Port Los Angeles? You said that the outer harbor at San Pedro had advantages over Port Los Angeles?

Mr. PATTERSON. It seems to me that it certainly has.

Mr. HOOD. Well, you said that. Have you any idea how far the 5-fathom curve lies from the foreshore in San Pedro Bay between near Point Firmin and opposite Timms Point?

Mr. PATTERSON. I don't know that I can give you the figures.

Mr. HOOD. Isn't that a rather important feature in an opinion on such matters?

Mr. PATTERSON. The figures are of record and can be easily obtained; but from my view of the two situations, it seems to me that it is impossible to utilize the Santa Monica Bay without building far out into the water.

Mr. HOOD. And that at San Pedro Bay it is not necessary to build out so far?

Mr. PATTERSON. It does not seem to me it is necessary. Then as to the inner harbor, which will undoubtedly be improved, there are abundant opportunities there for small wharves and for private ownership.

Mr. HOOD. I want to say that I am asking these questions for my information, and if I have been mistaken on some of the matters you can correct me.

Mr. FRANCIS. We have here a communication from Captain Swain, of the bark *Theobald*, running about on the lines masters of vessels have testified to, and with your permission, to save time, we will file it without reading. We will next present Mr. Robert Moore, the civil engineer in charge of our side of the controversy.

Mr. ROBERT MOORE, of St. Louis, a civil engineer, spoke as follows:

Mr. Chairman and gentlemen of the Board, in order to anticipate any inquiry on the subject, I may state that I particularly represent the interest of the Los Angeles Terminal Railway.

By the terms of the statute under which your Board is organized you are charged with two duties:

First. To fix the location for a deep-water harbor for commerce and of refuge, the range of choice being limited to either Port Los Angeles, the name given to the Southern Pacific Pier, in Santa Monica Bay, or to San Pedro; and

Second. Having determined the location of the said harbor, to make plans, specifications, and estimates for the works necessary to establish it.

It is my purpose to present, as briefly as I can, certain facts and arguments bearing upon the first of the two problems above mentioned, to wit, the location of the proposed harbor. In regard to the second problem—that of plans, specifications, and estimates—the parties whom I represent have nothing whatever to offer, knowing full well that after you have completed the examinations and studies which you have in progress you will be in a position to decide all questions which concern plans, specifications, and estimates better than anyone else possibly can be.

The harbor indicated in the statute is designed to serve two purposes—it is to be a deep-water harbor for commerce and also a harbor of refuge. The location which will best accomplish these two purposes is the one that should be chosen.

Though in naming these two objects the statute rightly puts commerce first, as being the more important end to be attained, it will perhaps conduce to clearness in discussing the proper location to invert this order and consider, first, at which place the end of securing a harbor of refuge can be best attained; and by the term "harbor of refuge" I shall understand, in the language of Harcourt, a harbor which shall

"serve as a refuge for vessels overtaken in a storm." To accomplish this end the harbor must not only afford protection against the sea, but must, above all, be easily accessible by vessels without assistance in all weathers.

Which, then, of the two points named is the better location for a harbor of refuge? In seeking an answer to this question it will simplify the matter to dismiss, for the moment, all thought of commerce, and consider each of the two proposed locations solely with reference to its advantages or disadvantages as a site for a harbor of refuge.

Taking up first Port Los Angeles, we find it to be situated at the northeast angle of the Bay of Santa Monica. The high hills on the north and east shores of the bay shelter this point from the winds coming from these directions.

The protection required by vessels, however, is not against the wind, but against the ocean swells, which never come from the north or east, but do come from the southwest, toward which quarter Port Los Angeles is fully exposed.

That the funnel-shaped form of the bay has a tendency to concentrate or pile up the waves at this point, such as is very often found in bays, is rendered probable by the greater height of the tidal wave in Santa Monica Bay as compared with San Pedro Bay. At San Pedro the mean range of the spring tides is 4.7 feet, while at Santa Monica it is 8 feet, or 70 per cent higher.

To the disadvantage due to the exposure of Port Los Angeles to the full force of the ocean swells is added the capital disadvantage of its being situated at the farthest angle or apex of the bay, which, as Mr. Hawgood has already pointed out, is for a harbor of refuge the most undesirable of all locations, for the reason that in case of failure of a ship for any cause to make the entrance the sea room is cut off by the converging shores of the bay; so that, in the words of Mr. Thomas Stevenson, quoted by Mr. Hawgood, "a harbor of refuge in the bottom of a bight may be regarded as a source of danger rather than a source of safety."

The place in this bay possessing the greatest natural advantages as a location for a harbor of refuge is Dume Cove under the lee of Point Dume, at the extreme northwest entrance of the bay. For the reason that it is under a projecting point, there is here ample sea room, the range of open sea being, roughly, 110 degrees greater than at Port Los Angeles, or as 235 to 125 degrees, and the natural shelter is very great. As evidence of the extent of shelter, I may cite Professor Davidson, who, on pages 48 and 49 of the *Pacific Coast Pilot*, fourth edition, speaks of Dume Cove in the following words:

"During a very heavy blow from the northwest in March, 1871, we were convinced that it was of importance as a harbor of refuge for vessels in heavy northwest weather. There was smooth water in the cove, the wind blew fiercely offshore over the neck of Point Dume, and small vessels could lie without danger or discomfort. It is good for all winds from southwest, west, north, and northeast. It was frequently used by the coast surveying schooner *Humboldt* in 1856, and reported upon favorably, and that a depth of 5 fathoms could be carried close inshore. It has no outlying dangers, and there is very little kelp at the anchorage, but the kelp should be avoided lest unexpected rocks may exist among it. For some years it has been used by vessels that have experienced its advantages, and thus obviated the necessity of running for San Pedro, about 30 miles to leeward, under stress of northwest weather."

In view of the natural advantages of Dume Cove, as thus set forth, and the great natural disadvantages as to form and exposure of Port Los Angeles, it is safe to say that if the Southern Pacific Company had not built its pier at the present location, no one would ever have thought of it seriously as a site for a harbor of refuge.

Turning next to San Pedro Bay, we find that, like Dume Cove, it is under the lee of a projecting point, and that it is already well protected from the prevailing ocean swells, on the west by Point Firmin, and on the southwest, though less perfectly, by Catalina Island.

The only direction in which the exposure is complete is the southeast, from which quarter there may come sometimes, though very rarely, comparatively heavy winds, but never heavy seas; for even in southwest winds it is admitted by all that the swells are from the southwest.

I say "comparatively heavy winds" for the reason that the records of the Weather Bureau show that on this part of the coast there are no heavy winds. In proof of this is the fact that at Los Angeles during nearly six complete years, beginning with 1891 and coming down to the present time, these records show no wind exceeding 30 miles per hour, to wit, a north wind in March, 1894. But in the records of the Weather Bureau no wind is termed a gale which has a velocity less than 40 miles per hour. So that during this period, and I know not how much longer, there has been in Los Angeles no wind which can be properly termed a gale.

To show how this compares with the winds on the Atlantic Coast and with those on other parts of the Pacific Coast, I submit the following table, compiled from the

records of the Weather Bureau, showing the number of storms which have occurred at different stations during the years 1891 to 1894, inclusive:

Name of station.	Number of storms.	Velocity of winds per hour (range of monthly maxima).
Atlantic Coast:		Miles.
Block Island.....	167	36 to 84
Hatteras.....	83	36 to 60
Galveston.....	21	25 to 54
Pacific Coast:		
Tatoosh Island.....	225	24 to 84
San Francisco.....	18	24 to 60
Los Angeles.....	0	12 to 39
San Diego.....	0	15 to 35

From this table we see that though the North Pacific Coast, as shown by the record for Tatoosh Island at the entrance of the Straits of Luca, is even more stormy than the North Atlantic Coast, there is at Los Angeles, as well as at San Diego, an entire absence of storms, in any proper sense of the word, and that at Los Angeles the velocity of the wind—that is, the range of monthly maxima—is lower than any of the stations named, lower even than San Diego.

To show the direction from which the winds come at this station, I have compiled another table which shows the percentage of winds from different directions at Los Angeles for five years, from 1891 to 1895, inclusive. For purposes of comparison, I have added the percentages as obtained from the records made by the keeper of the light-houses at Point Firmin. But as the methods employed by the light-house keeper are much less accurate than those of the Weather Bureau, the latter are entitled to the greater weight, although owing to differences of exposure even the same methods would undoubtedly give somewhat different results.

Directions from which wind comes.	Percentages.	
	Los Angeles.	Point Firmin.
North.....	7.96	40.44
Northeast.....	17.97	2.24
East.....	10.37	4.74
Southeast.....	4.09	3.82
South.....	4.16	7.48
Southwest.....	6.85	1.74
West.....	38.68	32.46
Northwest.....	9.92	7.08
Total.....	100	100

Taking the Weather Bureau percentages, we see that the directions of least frequency are the southeast and south, which together amount to 8.25 per cent of the whole. Using the light-house record, we find the winds from these quarters to be to 11.3 per cent, which is a substantial agreement.

The meaning of this, as applied to the problem in hand, is that the quarter toward which San Pedro is exposed to wind is that from which there are the fewest winds.

Taking this in connection with its location under a headland and its protection by Catalina Island against the heaviest ocean swells, we have a sum of natural advantages as a harbor of refuge for which there are but few equals.

In confirmation of these views we have the testimony of Professor Davidson, who, in the Pacific Coast Pilot (p. 38), issued by the United States Coast and Geodetic Survey for the use of mariners, speaks of San Pedro Bay as "well protected in every direction except against winter gales from the southeast round to the southwest." During the spring, summer, and autumn months, he says it is "an excellent roadstead." And although he advises vessels in winter to anchor "further out and more to the southward, in order to be able to slip their cables and go to sea should a heavy southeaster spring up with a large swell from the southwest," he also says, that "a vessel well-found in ground tackle is perfectly safe," and cites the case of the clipper brig *Fremont*, which in December, 1852, he saw "ride out a very heavy southeast gale of three days' duration." (Coast Pilot, p. 40). In other words, this bay is already

a natural harbor of refuge and for many years has been in actual use as such by a long line of shipmasters, of whom a few have testified before your Board.

To this testimony might be added that of almost every engineer officer who has ever examined the situation, or had charge of works at this point, many of whom in their official reports have commented upon the high degree of natural protection at San Pedro, and the desirability of supplementing it with such a breakwater as shall make it complete.

For example, Major (now Colonel) George H. Mendell, in a report upon a plan for the improvement of Wilmington Harbor, dated June 15, 1871, after remarking upon the shelter already afforded at San Pedro and the need of a good harbor at some point between San Diego and San Francisco, continues as follows:

"Under this condition of things it is apparent that a breakwater in the bay of San Pedro, which should give security to vessels under its lee at all times, would be a very desirable construction, and it is probable that at some future day, the commerce of this bay may attain such dimensions as to justify its construction."

I noticed this before any work had been done upon this harbor or any controversy had arisen about location.

Ten years later, in his annual report, dated July 16, 1881, he refers again to the same subject in almost the same words. After another ten years had elapsed and after the interests at Santa Monica had begun to assert themselves, this subject was again taken up, as you already know, in the years 1891 and 1892, by two Boards of engineer officers, both of which after carefully canvassing the whole situation in all its aspects—maritime, military, and commercial—decided unanimously in favor of San Pedro as the proper place for the proposed harbor. The second Board, that of 1892 (see Ex. Doc. No. 41, Fifty-second Congress, second session, p. 19), sum up the relative advantages of the two bays as sites for a harbor of refuge in words to the effect that the natural protection at San Pedro is a more perfect shelter from wind and sea than can be afforded by any artificial structure in Santa Monica Bay—a verdict which substantially expresses the opinion of both Boards and of every engineer officer who has expressed himself up to the present date.

Coming now to the objections which during the present controversy have been urged against San Pedro as a harbor of refuge, we find that since the statement of Mr. Hood in his remarks of the 21st instant, before your Board, to the effect that the holding ground at San Pedro, concerning which he had heretofore expressed grave doubts, "is good even without a breakwater," the only remaining objections may be reduced to two, which I will very briefly consider.

1. It is alleged that there is a westerly or upshore current which, if a breakwater be built, will cause the proposed harbor to fill with sand.

In the discussion of this subject before Congress, it has been repeatedly alleged that the Board of 1891 recognized this danger and made their plan of breakwater for the purpose of avoiding it. (See Mr. Corthell's paper of June 19, 1894, p. 6; Senator Frye's speech of May 11, 1896, p. 1). In his address of the 21st instant, Mr. Corthell, referring to a previous quotation from Senator Frye, says: "So the three army officers [meaning the Board of 1891] and the two civil engineers [that is to say himself and Mr. Hood] agree that if a breakwater is so attached and extended from the shore the harbor will fill up." Now, although Mr. Corthell afterwards, in response to my question, admitted that this statement in regard to the Board of 1891 was only a matter of inference, I desire to say that it is not justified by anything to be found in their report. For while this report gives the reasons for the plan adopted by them, it does not contain a single word about sand.

Now, if this upshore, sand-bearing current were a fact, it would no doubt have an important bearing upon the plan of breakwater to be adopted, but it would not be a determining element in making the choice as between the two locations unless all other things were equal, as in this case they are not. But from the testimony which you have heard you will, I think, agree that the existence of such a current has not been established as a fact. On the contrary, the preponderance of evidence points to a current in the opposite direction.

The general considerations alleged by Mr. Corthell tending to establish the existence of a northerly current along the coast of North and South America—even granting them to have all the force which he claims for them, as I do not grant—would establish it as a general fact only, and would leave room for innumerable exceptions, just as the fact of a current in a river is entirely consistent with the existence of any number of eddies and countercurrents along the shore. The fact as to the direction of the current at any point on the seashore, or even the existence of any current at all, is something to be proven or disproven by the local testimony, which in this case points to the conclusion that in the main the direction of the shorecurrent in San Pedro Bay is toward the east, and that the danger of the proposed harbor from silt is imaginary and not real.

2. The second objection brought forward is that as the slope of the sea bottom from a point 3 miles from shore is steeper in front of San Pedro than in front of Port

Los Angeles, a breakwater at the former place will be subject to heavier swells and will therefore be more expensive to construct and to maintain than at the latter place.

But even if this were true, it might not be important. For the real question is not at which location a breakwater can be built for the least cost, but rather at which point will there be the greatest return for the money.

The objection, however, is fully met on theoretical grounds by the considerations already presented by Mr. Hawgood, and also by the further consideration that from all the testimony the swells at San Pedro are not higher than at Port Los Angeles as a matter of fact, but rather the reverse, so that any theory to the contrary is either inapplicable or untrue.

I submit therefore that in view of these facts the decision heretofore rendered by the several engineer officers and Boards who have passed upon this subject, to wit, that the proposed harbor of refuge should be located at San Pedro rather than Port Los Angeles, should be affirmed.

We come now to the second and more important question, At which point will the interests of commerce be best subserved?

In order to answer that question it will be well to consider the further question, What are the requirements for a harbor of commerce?

In answer to this we may say that a harbor of commerce should be a port in which the vessel may come into the closest possible contact with every class of industry which has to do in any way with the ocean transportation of either freight or passengers. It should be a port in which the carriage, the dray, and the foot passenger, as well as the railway car may come directly to the ship's side. It should be a place where shipyards and repair docks can be built, and where warehouses, lumber yards, coal yards, fish canneries, grain elevators, and the manifold industries of a seaport can be easily and cheaply placed on the water's edge. It should be a place where single firms or individuals, or lines of steamships may have wharves for their own exclusive use. With less than this we may have a port of call but not a harbor of commerce.

With these requirements in mind, what are the opportunities for the development of such a harbor at the two points named in the statute?

And first, at Port Los Angeles, we find a long and expensive pier, well equipped with coal bunkers and tracks for the rapid handling of coal from vessels to cars, as well as tracks and platforms for the transfer of passengers and freight from cars to vessels or from vessels to cars, all in successful working order. But this is all. Every other phase of commerce is impossible. Any form of private industry is out of the question. Every passenger and every pound of freight transferred must pass over the railroad and pay tribute to the owners of the pier. Now, can this condition be essentially changed? Other railroads may be constructed and other piers built, though with ever-increasing difficulty and at a great expense. But the character of the business transacted will not be changed. The new piers will be new places for the transfer of passengers and freight from vessels to cars or from cars to vessels, and nothing more. Commerce in any larger sense will still be as much out of the question as it was before. The great expense attending the construction and maintenance of piers, to say nothing of the difficulties of access, except by rail, will forever forbid their construction by private individuals or firms, or even their occupancy of them as tenants, and the port will remain just what it is to-day, a large and expensive railroad transfer station, but not a harbor of commerce.

Turning now to San Pedro, we find in the outer harbor, under the protection of the proposed breakwater, the opportunity for the construction of piers for the business of railroad transfer of the type now existing at Port Los Angeles, to be all that can be desired. Mr. Hood states that the location formerly selected by the Southern Pacific Company is a good one, and that others, less desirable, perhaps, in some respects, but entirely practicable, can be found. In one important respect the location in San Pedro Bay will be better than at Port Los Angeles, and that is in the existence of a harbor bottom which will permit the construction for a considerable distance out from shore of permanent embankments, thereby reducing the cost of maintenance and lightening the burden which the traffic conducted over them will be compelled to bear.

In addition to the outer harbor and the opportunity which it affords for the business of direct transfer from ship to car, we find also at San Pedro an inner harbor which offers opportunities for the development of commerce in every other phase which are practically unlimited.

The success which has attended the efforts of the Government in deepening the entrance to this harbor is almost without precedent, and offers every encouragement to its further extension to whatever depth the needs of commerce may demand.

Where twenty-five years ago there was a channel not exceeding 2 feet in depth at low water, there is now one of 14 feet, and by waiting for a tide, ships drawing 18 feet are easily taken in. Nor has this channel shown any tendency to shoal up. On

the contrary, it has rather shown a tendency to deepen, and there is no reason why 26 or even 30 feet depth can not be obtained in place of the 14 feet which now exists. To the efforts which the Government has made commerce has promptly responded.

We find now at San Pedro two railroad wharves belonging to different and competing companies, at which ships can lie in still water and discharge or take on cargo with nothing to fear from either wind or wave. We find there a fish cannery, a yard for the repair of ships, and several large lumber yards, the successful establishment of which at Port Los Angeles, as you have been told by a most competent witness, Mr. Hooper, will forever be a commercial if not a physical impossibility.

By further dredging through material consisting of sand and shells, with occasional layers of thin shale, all of which experience has shown can be easily moved, the present ship channel can be extended for miles, if need be, into the lagoon—a work which will accomplish the double end of adding to the permanence of the channel by increasing the volume of the tidal prism and of giving room for additional wharves. These wharves may either be cheaply constructed, as now, of piles or timber, or if desired, the bottom is hard enough to allow the building of permanent quay walls of concrete. On the room thus furnished business of every kind can be transacted by the most convenient methods and at the lowest practicable cost. How great a saving this implies was shown you by the testimony of Mr. Hooper, from which it was seen that on the business of a single firm the absence of storage room and the necessity of immediate shipment on cars might add to the cost of the product \$90,000 per year, a cost which must of course be borne by the consumers. The present development of San Pedro is, therefore, but the beginning of a future commercial development which may take any direction or go to any extent which the future growth of the immense country to the north and east may hereafter demand.

To sum up, we find that Port Los Angeles is by nature a bad location for a harbor of refuge, and that its possible commercial development is limited to a single phase, and that a business which can be transacted only by great corporations.

At San Pedro, on the other hand, we find a harbor of refuge already existing, which needs only to be completed. Besides this, we find in the outer harbor ample opportunity for the kind of business now done at Port Los Angeles, and in addition, in the inner harbor, the opportunity for every other class of business and on any scale—in a word, the opportunity for the development of a great commercial harbor.

In our view, then, San Pedro is the only location which meets all the requirements for a harbor of commerce and of refuge such as is contemplated by the statute.

Mr. MORISON. Mr. Moore, you speak of locations; what do you consider the boundaries of Port Los Angeles?

Mr. MOORE. I can not speak definitely. I know that it is a name given to the pier built by the Southern Pacific Company. I don't know as there are any boundaries, except that it must be contiguous to that pier.

Mr. MORISON. Supposing a breakwater were to be built near Point Dume, in the position located; would that come within the conditions of the law?

Mr. MOORE. I should think not.

Mr. MORISON. If it were built midway between the present pier and Port Bollons, how would it be?

Mr. MOORE. My judgment would be, no.

Mr. MORISON. Well, going from Santa Monica Bay to San Pedro Bay, what do you consider the limits of San Pedro, in the meaning of the law?

Mr. MOORE. I should take it to mean under the lee of Point Firmin, and extending around, I don't know how far. Just that I can not say.

Mr. MORISON. Supposing a breakwater to be built in front of Long Beach, would that come within the meaning of the law or not, in your judgment?

Mr. MOORE. I should hardly think it would, but I can't say that it would not. It is a matter of legal question. I should think not.

Mr. MORISON. Supposing one were built from Deadmans Island to the southeast or east, would you consider that that did?

Mr. MOORE. I rather think it would.

Mr. HOOD. May I be permitted to ask Mr. Moore a question?

The CHAIRMAN. Certainly.

Mr. HOOD. Mr. Moore, we belong to the same profession, of which you are a very distinguished member. I would like to ask you if you will kindly consent, as a favor to me, and, with the consent of the chairman, wherever you have used the word "admits" in reference to myself, look over the record and modify it to the word "stated" instead of "admitted," wherever you can conscientiously.

Mr. MOORE. I will be very glad to do it.

Mr. HOOD. I would like to ask you a more practical question. You are perhaps familiar with Executive Document No. 61 of the Fifty-third Congress, second session. What are your ideas of the proposed improvements of the inner harbor?

Mr. MOORE. I have read it. I know something about it, but I am not very familiar with it.

Mr. HOOD. Have you ever noticed that at the end of the east jetty is the place where the channel is now the deepest, and that it heads eastward?

Mr. MOORE. I can not say that I know that. Really, I have given but very little study to it.

Mr. HOOD. I was going to ask you for your theory in reference to the position of that channel, but if you have not noticed it I will withdraw the question.

Mr. MOORE. Well, really I have not.

Mr. HOOD. Now, in reference to building embankments in the deep-water harbor with proper revetment in place of trestle for such approaches for the business ends of wharves, such as are considered suitable, do you think that those banks at San Pedro would be very much cheaper than a trestle approach composed of some treated timber, for instance?

Mr. MOORE. Well, I have not made figures on it, but in the absence of detailed figures I should say yes.

Mr. HOOD. The first cost?

Mr. MOORE. I should say the annual cost. The first cost and the cost of annual repairs.

Mr. HOOD. That is your opinion?

Mr. MOORE. Yes, sir.

Mr. HOOD. That, of course, as you say, would require some study. I believe you have studied the profiles of borings at both bays, have you not, to some extent?

Mr. MOORE. I have never seen the borings of San Pedro Bay.

Mr. HOOD. Have you seen the borings of Santa Monica Bay?

Mr. MOORE. Yes, sir; I have noticed them somewhat.

Mr. HOOD. On the line of the wharf?

Mr. MOORE. Yes, sir.

Mr. HOOD. As an engineer, do you think there would be any more difficulty in carrying out that same plan, of filling, instead of trestle approaches, at the Port Los Angeles foreshore, judging from the borings made there, than at San Pedro?

Mr. MOORE. My judgment as to San Pedro is based more upon my observation from the top of the bluff, and seeing a rock bottom for some distance out at low tide.

Mr. HOOD. You observed the rock bottom?

Mr. MOORE. Yes, sir; how far that extends I would not like to say; I saw nothing of the borings; only from my own observation those at Port Los Angeles seemed to be firm and hard.

Mr. HOOD. You are quite correct. I think your observations are correct at San Pedro. Did you see the borings for some distance out from the shore at Port Los Angeles? What was their composition?

Mr. MOORE. It was sand and clay, I think.

Mr. HOOD. Was the time of the borings noted, or did you notice it; that is, how long it took to bore so many feet?

Mr. MOORE. I did not.

Mr. HOOD. Did you notice whether it was noted as tough clay or firm clay, or sandy, or any remarks of that description?

Mr. MOORE. No. I may say that the only part of the record that I looked at with special interest was that of the borings beyond this breakwater and in front on the line of the last four or five borings, which included some of very soft mud.

Mr. HOOD. Then you have no opinion as to whether embankments could be built out and revetted without undue settlement and loss of material in what would otherwise be built as a trestle?

Mr. MOORE. I should say that possibly the bottom at Port Los Angeles might support such a bank.

Mr. HOOD. You did not look at it closely?

Mr. MOORE. No, sir; I did not.

Mr. HOOD. Would not your judgment be that firm clay with some sand or gravel over it is a good bottom for almost any purpose?

Mr. MOORE. Well, "firm clay" is a somewhat elastic term; it might be.

Mr. HOOD. You know nothing against a very firm clay being a good foundation?

Mr. MOORE. No, sir, I don't; except as it might be affected by the sea wash.

Mr. HOOD. You would not be prepared to say that the plan proposed for San Pedro would not be equally applicable at Port Los Angeles?

Mr. MOORE. No, sir; I would not.

Mr. BURR. I understand from your argument that you contemplate opening both the inner and the outer harbor for commercial purposes at San Pedro?

Mr. MOORE. I treat the two as one; the outer harbor to be adapted to such uses as it best serves—for example, the construction of piers of the type of the Port Los Angeles Pier—and the other for such uses as it would best serve.

Mr. BURR. The statute requires that the location shall be adapted for the purposes of a harbor for commerce and of refuge. What is your opinion as to the minimum depth which will fulfill both purposes, of commerce and of refuge?

Mr. MOORE. I think I should say a harbor into which you could take a 30-foot ship would properly be called a deep-water harbor.

Mr. BURR. For the purpose of a harbor of refuge or for anchorage, as you might put it?

Mr. MOORE. I should say substantially the same thing, with the qualification that in a harbor subject to swell, to accommodate a 30-foot ship you would need more depth under her keel. What that is I would not undertake to say.

The CHAIRMAN. You have got to have enough for her to swing over her anchor?

Mr. MORISON. If a ship drawing 30 feet were to anchor in your harbor for refuge, how deep water would you suppose to be necessary in forming your plans?

Mr. MOORE. I think I should be well satisfied with 36 or 40 feet—probably 36 or 40—I should be quite satisfied with that.

Mr. BURR. If the breakwater was so located as to secure 6 or 7 fathoms, you would consider that sufficient for anchorage purposes?

Mr. MOORE. That would be my judgment.

Mr. BURR. Supposing that in elaborating plans on those general limits you should find that the amount prescribed by law, or the sum to be expended, should be exceeded, what would be your opinion as to the qualification of the location under those circumstances?

Mr. MOORE. It is a little difficult to say, but I think I should cut my coat according to the cloth. I might attempt to stretch it a little, but not very much.

Mr. MORISON. You mean by that you would make the deepest harbor which the appropriation allowed?

Mr. MOORE. I would not say that absolutely. It might be that a difference in a harbor costing somewhat more would be so much greater that I would hesitate to do that. The question is a little too general.

Mr. MORISON. Have you formed any definite plans as to how you would make improvements to utilize the deep water at San Pedro as a harbor for commerce, assuming the harbor to be made by the construction of a breakwater or some such appliance; have you formed any definite idea of how you would adapt it to commerce?

Mr. MOORE. Not in detail; but I should certainly contemplate the establishment of a pier out in the ocean for ship transfer substantially on the line which the Southern Pacific built, which I think is a location very admirably chosen.

Mr. MORISON. By "out in the ocean" you mean within the protected harbor?

Mr. MOORE. Yes, sir. I mean within the protection of a breakwater; and if the other classes of business could not economically and successfully be handled in such a way I should arrange the harbor so that other classes of business could have accommodation inside.

Mr. MORISON. Where would you locate the breakwater?

Mr. MOORE. I really don't like to give an opinion about that.

Mr. MORISON. Well, when you spoke of the question of borings of course you must have had some reference to the location of a breakwater?

Mr. MOORE. I have really made no study of it, because I did not think anything of that kind was called for. You gentlemen had charge of that duty, and not I.

Mr. MORISON. But we desire to get the good advice of everyone to help us.

Mr. MOORE. I should want to be sure it was good. Whether that was the better place for a breakwater or not I would not attempt to say.

Mr. MORISON. The advocates for Port Los Angeles have proposed a location for a breakwater, and it is certainly right that we should ask you to propose a location.

Mr. MOORE. So far as I am concerned, I have no opinion.

Mr. BURR. Would you consider it necessary, if you were to locate a breakwater, to protect against both the southwest swells and the southeast winds, or only against the swells?

Mr. MOORE. The swells are so very much the more important consideration that after I had provided for those I rather think I would wait and see whether anything more was needed or not; and if so, I presume that something of the kind might be put out here which would be adequate; but in the first instance I rather think I should wait.

Mr. MORISON. Will you please designate what you mean when you say "put out here?"

Mr. MOORE. I mean something like a prolongation of the east jetty. That is something about which I have no definite or positive opinion. I think it could be done well enough; I see no difficulty about it.

The CHAIRMAN. You would want to place your breakwater so as to protect the mouth of the inner harbor, would you not?

Mr. MOORE. Yes, sir; but I presume that some such breakwater as this would do that sufficiently. I do not understand from the evidence that the swells produced by the southeast winds would be a sufficiently serious matter to justify any large expense on that account. The record shows that those winds are very rare, and it is a question whether the sea they raise is a very serious matter. The testimony of the shipmasters leaves me in doubt whether it is or not.

Mr. BURR. Would you consider it essential to make any further channel leading into the inner harbor; that is, deepening it?

Mr. MOORE. I think I should.

Mr. BURR. About how much?

Mr. MOORE. Well, I think that in the first instance if I could provide for the deep-draft ships engaged in actual commerce I should be satisfied. I mean aside from naval vessels, which would probably never want to come in here.

Mr. BURR. Supposing a ship drawing 27 feet of water were brought in, such as those which call at Port Los Angeles?

Mr. MOORE. Well, if I should want to bring such a ship in, I could do it by waiting for the tide. I think that would be sufficient.

Mr. BURR. What I mean is, whether you would consider it essential to deepen the channel to accommodate such a vessel; that is, the channel leading into the inner harbor?

Mr. MOORE. Well, that again might depend upon the traffic in which such a ship was engaged, whether it would want to go in the inner harbor; if I thought I could take it in the inner harbor, providing the water were deep enough so it could go in.

Mr. MORISON. What do you consider the greatest draft of a vessel engaged in commerce?

Mr. MOORE. In commerce on this coast?

The CHAIRMAN. This is a port being built for the commerce of the world, we are told.

Mr. MOORE. Well, if one deeper than 27 feet came I would recommend that the channel be made to fit it.

Mr. RODGERS. Mr. Moore, as an engineer, do you think that the proposed breakwater should be a closed structure and joined onto Point Firmin?

Mr. MOORE. I think it should join on.

Mr. RODGERS. You think there is no objection to that?

Mr. MOORE. I do not see any objection; no, sir.

Mr. RODGERS. You don't favor the open construction?

Mr. MOORE. Well, I don't like to be cited as giving a positive opinion about something I have not carefully studied, but from such study as I have given it I think I should not build it that way.

The CHAIRMAN. Not build it open?

Mr. MOORE. Not build it open. I think that the closed breakwater is the better one, though further study might change that opinion.

The CHAIRMAN. So far as you have an opinion on the subject now, would you build that breakwater as it is designated here or would you place it differently? The placing of the breakwater has everything to do with the success of the harbor, of course.

Mr. MOORE. My recollection of the site, from seeing it on the ground, and from a very casual study of the soundings, gives me the impression that it should begin farther out on the point [indicating]. I think you could get to deeper water, with perhaps a shorter breakwater, and have a little more room.

Mr. RODGERS. I want to ask you if you have had any experience in regard to the whipping of a wave around the end of the breakwater; as to what area would be protected? Where would the southwest swell reach, coming around the end of that breakwater, for instance?

Mr. MOORE. The arrow designates the line of the heaviest swell. I have no doubt it is correct.

Mr. RODGERS. Yes, sir; about southwest.

Mr. MOORE. I think it is likely that I might want to build a groin or two out from that side to break the swells. That is a matter of detail.

Mr. RODGERS. Of course if the sea runs around the end of the breakwater at such an angle as 45° the protected area or the area of smooth water is very much diminished?

Mr. MOORE. Yes, sir; I presume, however, that the swells as they go around the breakwater are reduced in height.

Mr. RODGERS. Suppose they are reduced, still there is testimony that there is some very rough water there.

Mr. MOORE. As I remember the testimony, it had reference rather to the meeting of two seas around the ends of the breakwater. However, that is something of which I have no positive recollection. I can not say I have ever had any experience or knowledge that justifies me in expressing an opinion.

Mr. RODGERS. How many ships should be accommodated—100, or 50, or how many should be accommodated at anchorage?

Mr. MOORE. That is a question pretty hard to answer. I think if I accommodated 50 ships it would fill the bill.

Mr. RODGERS. Since those plans were originally formulated the depth of ships has very materially increased. Twenty years ago there were no ships drawing 30

feet. There was only one vessel that I remember that entered San Francisco that drew as much as 26 or 27 feet, and that was an English naval vessel. Nowadays we have a great many vessels of commerce which draw as much as 26 or 27 feet when loaded.

The CHAIRMAN. About 30.

Mr. RODGERS. I don't know about 30, but I know a good many that draw 26 or 27 feet of water.

Mr. MOORE. Well, you gentlemen are better informed about that than I am.

Mr. RODGERS. It is quite an important matter to know what depth must be inclosed in that area which the breakwater protects.

Mr. MOORE. I have already stated that I should think 40 feet, or 7 fathoms, would be sufficient in the outer harbor.

Mr. RODGERS. There is one other suggestion which I wanted to make to you as an engineer, and that is that anything we do now that is inadequate to the future uses of commerce would be an obstruction rather than an advantage. If we start to build a harbor on too small a scale, because we have got only a limited amount of money, and put it in just such a position, it would only be in the way hereafter. If, as the people claim here, the commerce of the world is coming to this artificial port, anything we do now, if it is inadequate, will simply be an obstruction.

Mr. MOORE. Well, I should say yes; only there should be some limit to it. I don't think we should contemplate a hundred years ahead.

Mr. RODGERS. The trouble about it is, if you put anything in there that is inadequate, it may have to be taken out again, or be an obstruction.

Mr. MOORE. Well, all I can say is that in a forecast I would like to go clear into—

Mr. RODGERS. It is the old story of spoiling a horn and not making a spoon.

Mr. MOORE. I understand you.

Mr. RODGERS. And therefore it is very important to start right, and to start under such conditions that what work is done now may perhaps be added to without any further plan?

Mr. MOORE. Well, I should make the best forecast I could and go ahead, having in mind the general principle which you mention.

Mr. RODGERS. It seems to me absolutely essential that any work done now should be available for future use, and adequate to it.

Mr. MOORE. Your position is undoubtedly correct.

The CHAIRMAN. According to the plan now offered for that breakwater, proposed in 1892, only about one-quarter of the inclosed space of that outer harbor would be available for heavy ships, according to this map?

Mr. MOORE. I presume that is, but I am not sure but that would be sufficient. I have not studied it. I take it that with proper moorings in a sheltered harbor you could put them in pretty close.

Mr. MORISON. Whose business would it be to provide such mooring buoys?

Mr. MOORE. I don't know. The Government, perhaps, as far as it was a harbor of refuge and anchorage.

Mr. RODGERS. I would like to emphasize what I have said in regard to the increased draft of ships. I have often heard the question discussed, What was the object of limiting the channels shown upon our Coast Survey charts to a depth of 3 fathoms? The answer is that that was done about fifty years ago, when it was rare that you would come across a vessel of over 500 tons and that drew over 15 feet of water. Many harbors are prohibitive these modern days, because the ships draw twice as much as the channel affords. The length and tonnage of modern ships are entirely different from those of fifty years ago, and they have been increasing gradually ever since.

Mr. MOORE. My understanding is that the Atlantic liners draw, very few of them, over 28 or 29 feet.

Mr. RODGERS. Well, that is very much more than 15 feet.

Mr. MOORE. Yes, sir; but if I were provided with ample room for an Atlantic liner or a vessel of that class here I should be satisfied.

Mr. RODGERS. That is what this Board is expected to do, as I understand it.

Mr. MOORE. I should say that the present Atlantic liner would be a fair standard of what was needed for depth of water and for accommodations in a deep-water harbor.

Mr. RODGERS. Well, that is practically 30 feet?

Mr. MOORE. Well, I will not undertake to make any statement. I have waited for the tide to get into New York Harbor drawing 29 feet.

The CHAIRMAN. Now, the heavy ships go on fixed hours out of New York; they don't wait for tides. The channel is deep enough now to take them out.

Mr. MORISON. When was that?

Mr. MOORE. That was in 1892. Going into Liverpool you have to wait for the tide, and at Liverpool there is a pretty fair harbor.

Mr. MORISON. How much tide is there at Liverpool?

Mr. MOORE. I give it up. It is pretty heavy.

Mr. CORTHELL. There has been extensive deepening going on for twenty years, and the remarks made by one member of the Board about deep ships is being carried out all over the world.

The CHAIRMAN. Your plan contemplates an outer and inner harbor, both?

Mr. MOORE. Yes, sir.

The CHAIRMAN. You would deepen the entrance and deepen the inner basin?

Mr. MOORE. Yes, sir. Of course I would not think it necessary to complete the plan for any great number of years ahead; that is to say, I would let the future look out for itself.

The CHAIRMAN. That inner basin belongs to private individuals, don't it?

Mr. MOORE. I think not.

The CHAIRMAN. I don't speak of the water, but I speak of the shore on either hand.

Mr. MOORE. I could not give you any accurate information about that. I don't know.

Mr. RODGERS. When you look at the chart again, please to consider that the probabilities are that any port or location of deep water for commerce in this case will have to provide for a depth of 40 feet. Just remember that in looking at it. I merely want to say so because I think you will probably modify your ideas with regard to the location probably of that breakwater, as shown on the present plans.

Mr. MOORE. Well, as I understand the Board, I have no definite views, because I have not considered that in detail, or considered it was called for.

Mr. RODGERS. The Board wants to go right at the start, and not throw the work away, so what we do will be in the way for a right future.

Mr. MOORE. I should lay my plans as near as I could to accommodate the future.

Mr. MORGAN. Mr. Moore, I can readily understand the embarrassment that any engineer would be under in answering specific questions in regard to the location of a breakwater. They are established, are they not, upon the consideration of natural forces in the consideration of which no formula can be mathematically applied? Is that true?

Mr. MOORE. I think so.

Mr. MORGAN. You are familiar with the three plans that have been presented, are you not—the location of three breakwaters that have been presented for San Pedro?

Mr. MOORE. In a general way; yes, sir.

Mr. MORGAN. I mean by that, the plans of the first and second Boards of Engineers and also the design of Mr. Hawgood.

Mr. MOORE. Well, I have not really studied Mr. Hawgood's design. I have seen it.

Mr. MORGAN. You have seen it?

Mr. MOORE. Only looked at it casually.

Mr. MORGAN. Well, they were undoubtedly located upon the considerations suggested.

Mr. MOORE. Undoubtedly they ought to be.

Mr. MORGAN. They are all radically different, are they not?

Mr. MOORE. In some respects.

Mr. MORGAN. Well, in the main?

Mr. MOORE. Yes, sir.

The Board then adjourned until Monday morning, December 28, at 10 o'clock.

SIXTH DAY.

DECEMBER 29, 1896.

The hearing was continued at 10 a. m., all members being present.

The CHAIRMAN. Mr. Moore, we are ready for you.

Mr. MOORE. Mr. Chairman and gentlemen of the Board, as I stated at your last meeting, it was not my purpose to say anything about plans or offer any, as I considered it a case of carrying coal to Newcastle; but in response to your request, I have since the last meeting sketched out a plan, of course somewhat rudely, and I have placed it upon one of the Coast Survey charts, assuming, of course (as I must), that the surveys embody a correct representation of facts, though, of course, as to how closely they do now or not you will know better than anyone when you get through.

Before saying anything as to the plan, it may be worth while to state the problem, as I understand it, which any plan must solve, and that is, the plan must provide a sufficient area of protected anchorage at the least possible expenditure of money. This map is so small that I can not show it except by bringing it up to you [takes chart to desk].

The essential feature of the plan, as I understand it, consists of the breakwater, which I have placed between the 7 and 9 fathom contour, beginning at a point which

is marked B and extending for the present to a point which I have marked C, which is on the 9-fathom contour, and which admits, as you will see, of extension for quite a long distance, keeping very close to the 9-fathom contour. If you extend it 5,000 feet out it comes into shallower rather than into deeper water. That is, this line may be extended to there [indicating on map] and still be about 5,000 feet over there, and still on the 9-fathom contour. This breakwater BC, which I have considered the essential feature, I have connected with the shore in such a manner as to give the shortest possible reach of breakwater. I consider, however, that it is entirely feasible, and might be hereafter considered desirable to extend it from B to A or to extend to some other point, say X, upon that reef, which in itself acts as a breakwater, and might almost dispense with the part AB altogether. Of course it is of no value, and never can be of any value as an entrance for ships because of that reef. I have also added, merely by way of suggestion (whether it may be desirable or not I will not undertake now to say), an extension of the east dike in the direction of the bell buoy.

Mr. MORGAN. The end of that is where?

Mr. MOORE. The end of that is at the bell buoy. The bell buoy, as I understand it, is placed upon what is understood to be a rock at 3 fathoms.

The CHAIRMAN. It is 17 feet. The buoy is placed just southwest of it.

Mr. MOORE. That is added as a feature not to be now constructed, but rather something which may be constructed hereafter if it should ever be required. This opening as now left between point C and point E, the bell buoy, which for practical purposes is the limit of the entrance upon that side, is about 5,000 feet, which is certainly ample and experience may show it is more than ample. In that case of course it will be entirely practicable to close it to any extent that experience may show is desirable or necessary by extending the breakwater either from C or D toward point E.

Mr. RODGERS. What is the area included in that?

Mr. MOORE. The available area between the 5 and 6 fathom contour is 131 acres, which provides anchorage room for 52 ships, assuming the ordinary allowance of 2½ acres to the ship, which I consider more than ample; between the 6 and 7 fathom contour, 145 acres, which allows anchorage room for 58 ships; between the 7-fathom contour and the breakwater, and the line making an angle with the breakwater of 45°, 175 acres, or room for 70 ships in water 42 feet deep or over.

Mr. MORGAN. Does that angle limit all of the area—that line across there?

Mr. MOORE. It is all inside of the 45° line.

The CHAIRMAN. If the breakwater was only built to BC you would reduce your amount somewhat, I suppose?

Mr. MOORE. Yes, sir; but as long as this line of 45° has been introduced into the discussion, I have introduced that as a limiting line. The total, as you see, foots up room for 180 ships, which you may divide by 2 and still have all the room that is necessary for commerce at present.

I will say, by the way, that figuring the quantities from the point A to the point C and using for the purpose of comparison the same section which was used by the Board of 1892, the cubic yards are about 1,400,000, which is a little less than the number of yards stated by the Board of 1892.

Now, in regard to that plan, there are several advantages which are worth calling your attention to, as the matter is now brought into the hearing. One is the very wide entrance which it provides, particularly in the deep-water offing looking toward Long Beach. You see that there are practically 5 or 6 miles of water area in which you reach nothing less than 5 fathoms, so that a ship in turning here [showing] has plenty of room, in which respect you will notice that it has a very marked advantage over the plan at Port Los Angeles, where the room between the 7 and 4 fathom contour is very much less than it is at this point. So that a ship in thick weather would have very much less room to recover herself at Santa Monica in case she failed to make the entrance at first.

Then I think another advantage that is worth noting is the very great elasticity of the plan, as it admits of extension to almost any desired limit in future, so that if you choose you could accommodate, by an extension of the breakwater noted there, the commerce of the year 2000, which I think is certainly far enough to look ahead in considering any plan at this date.

There is just another matter which is worth mentioning, and that is that the angle of the breakwater is not normal to the angle of the swells. Now, I know that in this I am obliged to differ with my friend, Mr. Corthell, in that I consider that a distinct advantage and not a disadvantage. Without arguing the matter at all, I think it will be sufficient to refer you to a paragraph from a paper by Mr. Thomas Stevenson, who, as you know, is one of the most celebrated engineers in this line of work that we have had in the last half century. It is a quotation from his articles in the *Encyclopedia Britannica*, Volume XI, page 409:

"The extraordinary difference between waves which impinge at right angles and others which have even a very slight amount of obliquity has been shown in the

most unmistakable manner at the Wick Breakwater, where all attempts to make the work stand when exactly at right angles to the waves has hitherto been unsuccessful. It was found by observation that while waves coming from the direction of south by east struck the outer part at normal incidence, they struck the landward end of the same cant at an angle of 81° , giving 9° of obliquity. This small measure of relief was found to make a great difference in the impact upon the wall."

I will say by the way that the Wick Breakwater is one on the coast of Scotland which was constructed by Mr. Stevenson, and which was at first destroyed by waves of almost unprecedented violence, so that a block of concrete weighing, I think, 2,600 tons, was moved bodily, and thrown over into the inside of the breakwater.

Now, so far as testimony and authority go, I submit that that is sufficient to show that an angle with the prevailing swell is a decided advantage, and not a disadvantage.

Mr. CORTHELL. Mr. Moore, in making this outline for a breakwater, have you taken into account the seas from the southeast and the difficulty of anchoring there under those seas?

Mr. MOORE. Only to a very limited extent. As testified here, I suppose that in the southeast only a mariner would not attempt, perhaps, to make a breakwater either at Port Los Angeles or at San Pedro. As Captain Polhamas testified, he would probably go to Catalina Island.

Mr. CORTHELL. Still, we have in your testimony, or the testimony of someone on the other side, a statement from Professor Davidson that there was a heavy southeaster lasting three days, and during that time he would run to Catalina.

Mr. MOORE. If the ship had entered there, she would be all right. As to the entrance under thick weather, that is something I would not like to testify about, as I am not mariner enough to give an opinion. So far as I have an opinion, it is that in stress of southeast weather, particularly in thick weather, a mariner would not enter either breakwater in a southeast gale.

Mr. CORTHELL. Now, you speak about vessels being at anchor there in a southeaster lasting, we will say, two days or longer, with a violent wind from that direction, which, as you know, is the direction of the violent winds on this coast; would a vessel not be in danger with 5,000 feet of an opening facing the southeast?

Mr. MOORE. In view of the testimony of Professor Davidson, with a ship riding three days at anchor in a southeast gale, I should say no.

Mr. CORTHELL. You would consider it a harbor of refuge in a southeast storm?

Mr. MOORE. I will say this, that if experience shows that protection against southeast gales is needed, it is entirely feasible to close the opening so it will be safe under all circumstances; that is, to reduce the opening.

Mr. CORTHELL. If it is reduced, don't that reduction reduce the measure of safety in entering that harbor both in a southeast and southwest storm?

Mr. MOORE. I think it is desirable to keep the opening as wide as possible, but it could be very greatly reduced and still be practically larger than the entrance at Port Los Angeles.

Mr. CORTHELL. I would like to ask, when you speak of Port Los Angeles, why it is difficult to enter Port Los Angeles in a southeaster?

Mr. MOORE. One difficulty, as I indicated, is the fact that you have less margin for accidents. You drift easily to the 4-fathom contour or else onto the beach. I do not know the scale of this map. In San Pedro the distance to 4-fathom water in the direction of Long Beach is 6 or 7 miles.

Mr. CORTHELL. Will you, for the information of the Board, place your pencil at Port Los Angeles in the direction of the southeast wind, simply to see whether it impinges on the shore or not?

(Mr. Moore shows on map.)

Mr. CORTHELL. South 54° east. Does that bear out your remark in reference to getting on the shore there in a southeaster?

Mr. MOORE. It surely would if those piers were built.

Mr. CORTHELL. There is an opening half a mile wide there.

Mr. MOORE. I don't think there is any question about that. You are in shallow water here [showing on map east of proposed wharves at Santa Monica].

Mr. CORTHELL. I would like to ask one more question. If this harbor is made according to your plan, what will become, in your opinion, of the detritus that is discharged, as it is at various times, from the mouth of the jetties with the current in either direction?

Mr. MOORE. I have very little doubt but what it will be carried out to sea.

Mr. CORTHELL. Let me ask, Mr. Moore, if issuing from the jetties as they now are and with the current moving to the eastward, as your side here has attempted to prove, doesn't the breakwater itself cut off that current so that it falls into dead water, so far as current water is concerned?

Mr. MOORE. The water issuing from this lagoon, which will issue, I fear, only at too great a velocity, will undoubtedly carry it beyond the entrance of the harbor.

The tides, as you well know, rise in two stages, so that practically the tide is rising eighteen hours and flowing but six, so that the velocity of the ebb tide is greater than the velocity of flood, and with this lagoon deepened, as it unquestionably will be in the future, the only question in my mind is whether you may not acquire a velocity that is rather too great, so as to involve the necessity of widening that entrance.

Mr. CORTHELL. I would like to pursue the subject a little further. In Executive Document No. 61, Colonel Benyaud's report, is a detailed chart of the mouth of this river, and it shows that the mass of the bar is not to the eastward, but directly out, and so stated by him as the direction of the ebb tide when it moves out. If I am in error you can correct me. He states that the flood tide moves in from the eastward; the ebb tides move straight out. Isn't that direction such as to carry this detritus directly in the pocket you make by your breakwater?

Mr. MOORE. I will say that this plan shows a short distance in front of the mouth a hole in which you have 5½ fathoms of water—at a short distance immediately in front of the breakwater—so that it is a very short distance before you get into what is a hole. So I see no reason, so far as I have examined the matter, for anticipating that. In fact, the presence of that whole in front of the breakwater would seem to dissipate all apprehension for the time being.

Mr. CORTHELL. When a breakwater is there, don't it change those conditions that now exist in reference to that particular feature?

Mr. MOORE. As I have explained, the water from the ebb tide must certainly go out to sea.

Mr. CORTHELL. Excuse me. I am referring to Colonel Benyaud's statement. It does not go out the way you made your pointer go out.

Mr. MOORE. I am simply expressing my opinion, as I stated before. I have given no careful study to Colonel Benyaud's report, and I am not now in a condition to discuss it.

Mr. CORTHELL. I would like to ask one more question about this discharge of sediment, which it would seem to me is quite a factor, although not a very large one in this matter, I must confess, and that is: Have you an idea or do you know the extent of the watershed of these small streams that come into Wilmington Bay at present?

Mr. MOORE. I do not.

Mr. CORTHELL. Not the amount of detritus they carry during these heavy storms?

Mr. MOORE. No, sir.

Mr. CORTHELL. Are you acquainted with the amount of rainfall and other features of that kind, the velocity of the currents, and the amount of detritus that is carried?

Mr. MOORE. Only to a very limited extent, because I consider it a matter of little moment. It is easy to keep it out of the harbor. It practically goes out now; does not affect the harbor at all. This entrance is easy to maintain ad infinitum, and the problem of keeping the whole sediment out is one of great simplicity, so that I have not given it any study.

Mr. HAWGOOD. I have made some remarks concerning Plymouth Harbor. I would like to file a map of that harbor.

Mr. MOORE. At the request of the Los Angeles Terminal Railway Company, Mr. Gibbon, their vice-president, will address you.

Mr. T. E. GIBBON addressed the Board as follows:

Mr. Chairman and gentlemen of the Board, as Mr. Moore has said, I appear before the Board as the representative of the Los Angeles Terminal Railway Company, a corporation with which I have been connected, either in the capacity of vice-president or attorney, since its organization.

The corporation was organized for the purpose of acquiring, owning, and leasing to larger systems of railway terminal facilities in the city of Los Angeles and upon the ocean at San Pedro Harbor. It has already spent some \$3,000,000 in purchasing land and making improvements with this end in view.

It may be unnecessary to say that I shall not endeavor to touch upon any of the technical features involved in the selection of a proper site for the proposed harbor, but shall confine myself in what I shall have to say with reference to the respective harbor locations named in the law under which your Board was appointed to the merits or demerits of the proposed places as they may affect companies engaged in land transportation, and I shall endeavor to call your attention to those points in each location which, from a somewhat careful study of the respective locations, appear to me to be most favorable or unfavorable to the operation, as successful and efficient servants of commerce at each place, of transportation agencies of the kind that I represent.

It may, however, be of some assistance to the Board in understanding the points which I shall endeavor to make if I am permitted to give a short history of the development in marine and land transportation agencies which has occurred within

the last few years upon the coast contiguous to the city of Los Angeles. In the year 1880 the city of Los Angeles was a comparatively small town, shown by the census to contain, I believe, 15,000 population. This population increased with something like ordinary growth until about 1885, when the building into the city of the Santa Fe Railway afforded this country a second transcontinental line, the Southern Pacific having been the first. This was immediately followed by what was known as the "boom" period, which produced such an immense increase in population and growth in development of the country that the census of 1890 showed Los Angeles to be a city of 50,000 people, and to have experienced during the decade from 1880 to 1890 a growth of 351 per cent, being the maximum of municipal growth shown in the United States for that period. The boom brought with it a large growth of commercial interests, some idea of which may be gained from the testimony of Captain Weldt as to the number of deep-water vessels that found anchorage at San Pedro during the years between 1884 and 1889, which were the years that marked the growth, culmination, and decadence of the boom. As the intense and somewhat unnatural business activity of the boom decreased the number of vessels coming to San Pedro—at that time the only port for Los Angeles—also began to show a falling off, until by 1890 there was nothing like the amount of commerce to this part of the coast that there was during the period of the boom's existence. A considerable portion of that commerce had also been attracted to another and newer port. In the year 1887 a wealthy transportation company which before that time had been operating on the northern Pacific Coast purchased several hundred acres of land on the bay of Santa Monica, at a place which has been referred to here as Redondo. They there erected a substantial pier, which, owing to the peculiar formation of the bottom of the ocean at that place bringing deep water close luto shore, was built at a very moderate cost. The company also constructed a line of railway from their pier to the city of Los Angeles. This pier was opened for business in the latter part of 1888, and during that year the Santa Fe Railroad also built a line connecting it with this city. I think I may safely say that from the date that pier and the railways connecting it with Los Angeles were opened to traffic until the pier at Port Los Angeles was completed the Redondo pier accommodated, as a port of call, nearly all the deep-draft vessels coming to this part of the coast with consignment of general cargoes for Los Angeles, by reason of the fact that such vessels could there unload directly upon the cars without the expensive and troublesome method of lightering their cargoes to the shore followed at the San Pedro anchorage. The Redondo pier had in addition become a regular port of call for the vessels engaged in the coast traffic between San Francisco and San Diego, and by reason of being somewhat nearer in point of time to the city of Los Angeles for the business from the direction of San Francisco it had from the first secured a large part of that traffic.

By the year 1890 the city of Los Angeles had become of such importance commercially, and the country tributary to it had increased so largely in population that it became evident to its commercial interests that the future development of the city and surrounding country required, for the proper accommodation of its probable future maritime commerce, a harbor in the fullest sense of the term, and not a mere port of call such as had been and would be the character of the unprotected anchorage of San Pedro and the pier at Redondo. This feeling was emphasized by the fact that Los Angeles was the only point on the coast having competing lines of transcontinental railways, and by the further fact that those lines of roads afforded a shorter land route from the commerce of the Pacific islands and the Orient to the cities of the East than did any of the other railways reaching the Pacific Coast, and were not exposed to interference by storms and winter snows such as for some months of the year seriously cripple other transcontinental railways.

Impelled by these considerations, the business community of the city of Los Angeles and the surrounding country began an earnest agitation for the construction of a deep-water harbor which should be capable of accommodating in the best manner the maritime commerce which they hoped their superior railway facilities would attract. The first substantial result of this effort was that in the river and harbor act approved September 19, 1890, provision was made for the appointment of a Board of Engineers to examine the Pacific Coast between Points Dume and Capistrano with a view to determining the best location for a deep-water harbor.

On December 18, 1891, the report of the Board was made selecting San Pedro as the best site for the proposed deep-water harbor, and that report is before this Board as Executive Document No. 39 of the Fifty-second Congress.

I may say, in passing, that during the consideration by the Board of the matters submitted to them arguments were presented favoring the two places—San Pedro and Santa Monica—the Santa Monica arguments being presented under the auspices of an organization formed in that seaside town.

Influenced by the belief that a determination of the matter submitted to the harbor Board by the act of September 19, 1890, would result in the construction of such a deep-water harbor as was sought, and in confidence that the harbor would be con-

structed at San Pedro a body of Eastern capitalists prepared to organize the Los Angeles Terminal Railway Company, and purchased, in the latter part of the year 1890, certain properties in the city of Los Angeles and upon the water front in the inner harbor at San Pedro for the purposes which I have heretofore mentioned. Beginning in the early part of the year 1891 this company during the year constructed a line of railway extending from the city of Los Angeles to its properties on the Bay of San Pedro. It was also a part of its scheme to promote the building of a line of railway extending from Salt Lake City and forming a connection with its terminals in Los Angeles and at the harbor for the purpose of giving a direct connection with this coast to about 10,000 miles of railway lines having terminals at Salt Lake City, and not then or at present having any direct connection with this coast. This would also have had the advantage of being by about 300 miles the shortest line between this point and Eastern cities.

About the middle of the year 18-8, the same year that witnessed the opening for business of the Redondo Pier, the Southern Pacific Company discontinued the work upon its pier projected into the outer anchorage at San Pedro.

The deed records of our county show that on July 30, 1891, a deed was executed conveying from Abbott Kinney to Frank H. Davis (whom it is understood from the statements made before the Board is the representative of Mr. Huntington) certain property fronting for 2,200 feet on Santa Monica Bay, commonly known and described as the Santa Monica Heights tract.

On December 23, 1891, a deed was executed by John P. Jones and Arcadia Baker, conveying to the Southern Pacific Railroad Company the right of way for a railroad which that company now uses between its tunnel and its wharf at Port Los Angeles, excepting that portion running through the 2,200 feet of frontage of the Santa Monica Heights tract, which appears to have been conveyed by Frank H. Davis by deed dated December 28, 1891.

In the latter part of 1891 or the beginning of 1892 the Southern Pacific Company began the extension of its tracks from the terminus which it had theretofore had in the town of Santa Monica to the present site of its pier at Port Los Angeles and began the construction of that pier.

In January of the year 1892 the commercial interests of the city of Los Angeles decided to make a strong effort to secure from Congress, then sitting, an appropriation to begin work upon the deep water harbor, as recommended by the Board of 1891. In this matter the company which I represent was, of course, deeply interested, and in January of that year Mr. Charles Forman, a citizen of means and prominence in our city, as the delegate of the chamber of commerce, and myself, representing the Los Angeles Terminal Railway Company, went to Washington City for the purpose of appearing before the Senate Committee on Commerce and urging the propriety and necessity of that committee favorably recommending a measure which had been introduced by Senator Charles N. Felton, then representing this State in the Senate, appropriating about \$250,000 to begin the construction of the proposed harbor. Shortly after we reached Washington City a day was appointed by the commerce committee for the consideration of Mr. Felton's measure, and Mr. Forman and myself were to have had a hearing before the commerce committee for the purpose of urging a favorable report.

When the matter was called up upon the day appointed, Senator Frye, chairman of the committee, exhibited to the committee a telegram which he had just received from the chief engineer of the Southern Pacific Company, stating that the holding ground for ships in the area of the proposed deep-water harbor at San Pedro was bad, and suggesting the propriety of a further investigation upon that point when the Government undertook the large expenditure recommended by the Board of 1891 for the construction there of a deep-water harbor. This destroyed any chances for favorable recommendation which Senator Felton's measure might have had. In order that no time should be lost upon the matter, Senator Felton immediately took steps which resulted in the appointment of the Board of Engineers of 1892, Colonel Craighill, chairman. The report of that Board and the subsequent history of the matter is probably so well known to this Board that it is not necessary for me to touch upon them.

I trust that I may be pardoned, however, in observing that, in the light of the statements which have been made upon this hearing as to the equality of merit in the holding ground at the two places, it was probably unfortunate for the interests of commerce upon this coast that the question of the possible defective character of the holding ground at San Pedro should ever have been raised, and the fact that it was raised may to some extent account for the attitude which has been assumed toward this matter by certain Members of Congress, for it is a certain fact that this matter of holding ground has been of such effect in some quarters, that Senator Frye, in the speech which he made upon this harbor question on May 11 and 12 last, in the Senate of the United States, speaking of a report which an engineer had made to Mr. Huntington as to the demerits of San Pedro, said: "He (the engineer) said

that a large part of the area within the breakwater was upon rocky bottom and there was no proper holding ground. On this report," continued the Senator, "the Southern Pacific Railroad deserted the \$3,000,000 planted down at San Pedro, and went up and planted \$1,000,000 in building at Santa Monica . . . the finest wharf or pier in the whole world." And we find the statement reiterated in Mr. Huntington's letter to Secretary Lamont, of date as late as June 16 of this year (see Document F of the typewritten documents filed by Mr. Corthell with your Board).

The outgrowth of the whole matter, after the years in which it has been under discussion, has been the appointment of this Board whom I have the honor now to address.

I think it will be seen from the foregoing that the harbor sought by the commercial interests which had begun and have prosecuted this effort to obtain a deep-water harbor upon the portion of the coast near the city of Los Angeles, was a harbor offering advantages to commerce entirely different from, and much more extensive than, were offered by either of the then existing ports, San Pedro or Redondo, or any part of that character.

It was in anticipation of the construction upon this coast of such a harbor that the corporation which I represent invested its money here, and with the further anticipation that when such a harbor was constructed it would be of sufficient commercial importance to the large extent of country lying east of California to enable its promoters to offer such inducements as would secure for their terminal system a connection with the railway lines having their western termini at Salt Lake City, and for which the proposed harbor would be the nearest and best Pacific Coast port.

It may be pertinent here to quote to this Board what the Board of Engineers of 1892 said in their report as to the commercial significance of the proposed harbor. On page 4 of their report occurs the following:

"By far the most important aspect of this subject, however, is its relation to the probable future development of the deep-sea commerce of the country. Heretofore the Asiatic trade has naturally gone to San Francisco, but it has been pointed out that the construction of the Canadian and Northern Pacific railroads has introduced two competitors for the overland transportation of the Asiatic commerce. Two through lines—the Southern Pacific and the Santa Fe systems—cross the continent from Los Angeles at much lower elevations than the northern lines, and also connect the Pacific with the Gulf of Mexico, and their operation is never obstructed by snow or ice. If a safe, accessible, and convenient harbor for deep-draft vessels existed on the southern coast, these would appear the most favorable lines for the transportation of Asiatic and Australian commerce.

"Should the Nicaragua Canal be completed, the importance of the proposed harbor will become still greater. At the present time the most convenient course for sailing vessels coming around the Horn is to go out in the mid-Pacific and strike the trade winds to make the port of San Francisco. With the completion of the canal commerce will be principally transported by steam vessels of moderate draft, which will move north along the coast, and seek the nearest favorable and convenient port from which their freight can reach its market.

"A deep-water harbor on the southern coast would thus receive the Asiatic and Australian freights for shipment over the most favorable transcontinental lines, accommodate a large part of the commerce passing through the Nicaragua Canal which now goes around the Horn, and finally furnish a port of shipment and supply not only for the productive territory in its immediate vicinity, but also for the great interior reached by the southern railways beyond the mountain ranges. Considering, therefore, the probable needs of commerce in the near future, the Board is of the opinion that the proposed deep-water harbor is of high national importance, and well worthy of construction by the Central Government."

If the provision of this Board, expressed in the foregoing quotation, shall be realized, and there would seem to be no reason why it may not be and many reasons why it probably will be, the harbor which this Board is now called upon to locate will probably at no distant date become the most important harbor upon the Pacific Coast, commanding as it will the major part of the transcontinental commerce, and being the first to receive for distribution over the western half of the continent the great commerce which certainly will come from the East through the Nicaragua Canal when it is completed.

In such a harbor, I submit, it is of paramount importance that the facilities for its use by competing lines of transportation and by all commercial interests which may desire to have access to its waters for the purpose of receiving or shipping freight, should be the most extensive, convenient, and inexpensive possible. These prime necessities will, in my opinion, be impossible of attainment at the harbor which the Southern Pacific Company proposes shall be constructed by the Government in Santa Monica Bay, for the reason that there can be no competitive use, in a broad commercial sense, of that harbor.

This Board, from personal observation, is aware that the coast line facing the

whole of the protected area of the harbor at that place consists of cliffs averaging about 175 feet in height, separated from the water by a very narrow strip of sandy beach, in width at some places a little more than 100 feet; that for a distance of over 2 miles the only approach to the area by the proposed breakwater is also a narrow beach; that the Southern Pacific Company is the owner of a considerable portion of the width of this approach for all of the distance and of nearly the full width where its 100 feet width of right of way begins at the eastern edge of the protected area of the harbor. That portion of the proposed water front not owned by the Southern Pacific is shown by the map filed with this Board by Mr. Hawgood to be owned by Messrs. Jones and Baker. What is not shown by that map is shown to have been owned by Jones and Baker, except a very small part.

Mr. MORGAN. This map is dated June, 1893?

Mr. GIBBON. Yes, sir.

Mr. MORGAN. Has there been any change?

Mr. GIBBON. No; as far as I am aware of, unless it is by extension of the Southern Pacific ownership west of the wharf, but that map does not undertake to show anything west of the wharf.

Mr. MORGAN. I suppose this is taken from the records?

Mr. GIBBON. Taken from the county records. You will see from the certificate of the draftsman where his data were obtained. We have thus a proposed location for a harbor which the Government is asked to construct whose whole water front and the narrow approaches thereto are entirely owned by three proprietors.

It is true that the act authorizing the existence of this Board provides that before the money appropriated to be expended shall be expended the Southern Pacific Company shall execute an agreement to share equally with any other railroad company paying its proportion of the cost "the use of its pier and the approaches thereto situated westerly of the easterly entrance of the Santa Monica Tunnel."

It will be observed, however, that the provisions of the law do not extend to sharing or dividing with any company any property which it may have obtained on this water front other than that used for approaches to its present existing pier and the pier itself. It will also be observed, from the maps filed with this Board by the Southern Pacific engineers, that this company owns a strip of land aligning the water front of that half of the protected area of the proposed harbor extending westward and beyond its present pier.

There is a right of way shown here on this map. I don't know what width it is.

Mr. HOOD. There is no ownership there.

Mr. GIBBON. How about this here?

Mr. HOOD. Shall I help out the proceedings by saying to Mr. Gibbon that just beyond the little area that is shown as occupied by our engine stall there is no other ownership for some little distance, except a half or three-quarters of a mile, which is owned by Jones and Baker, and beyond there the ownerships are just as shown.

Mr. GIBBON. The Southern Pacific, then, controls a large portion of the water front of the protected area extending westward of its present pier?

To this holding, and to any piers which may be constructed in the west half of the harbor, and to which this land might be used as an approach, it would appear that this law will not apply.

It has also appeared in evidence that a person deeply interested in the welfare of the Southern Pacific Company owns in fee the land fronting the proposed harbor for 2,200 feet extending eastward from the present pier of the Southern Pacific, which is situated exactly in the center of the proposed protected area. The ownership of this land carries with it, under the laws of this State, title in fee to mean high tide. An examination of the map which I herewith file with this Board will show that between the line of mean high tide and the southerly or ocean line of the 100-foot strip of right of way which the Southern Pacific Company has acquired through this property there is a small line of beach constituting a sufficient holding to entitle the owner to invoke the right of accretion in asserting title to any extension of this land into the waters of the bay. This will also entitle the owner to use this land as landing places for other wharves, and those wharves and the approaches thereto over the strip of land will not be subject to the requirements of the law as to joint ownership. It is probable that for the remaining 2,000 feet next to the eastern line of the proposed protected area of this harbor the protection would not be sufficient to encourage the building of long and costly wharves in that portion. Certainly, wharves located there would not be so favorably situated for the transaction of business as would be those located on the other and more protected portions of the harbor.

So we have in this harbor a railroad company already occupying a right of way along the whole 8,000 feet of the proposed front, only half of which is subject to the law with reference to joint ownership, but all of which forms approaches to wharves which may be run out into any portion of the protected area from any part of the frontage. In addition to that this company practically controls all of the available

land for other purposes on 2,200 feet of the 4,400 feet of water front which will enjoy the maximum of protection, and such control, outside the narrow right of way from the tunnel to the present pier, is not subject to the provision as to joint ownership. Should the commerce of this port increase to an extent which will make the building of other wharves necessary, under the conditions as they exist, it is not hard to imagine the occupancy by the Southern Pacific Company of practically all of the protected area by wharves which it shall construct, only one of which, and the narrow approaches thereto, would be subject to the provisions as to joint ownership and control. So that it is not going beyond the bare facts of the case to say that along the whole front of this harbor the Southern Pacific has and will have, in spite of the provisions of this law, a superior right which no other company can afford or will endeavor to compete with. It is unnecessary for me to call the attention of the Board to the intolerable burdens which, by virtue of this ownership of property along the whole of the front, a large portion of which is not affected by the law as to joint ownership and use, might and certainly would be imposed by this company on any rival company attempting to compete with it for the business of this harbor.

It has been said that a railroad company could avail itself of the right of eminent domain for the purpose of condemning, over the land not owned by the Southern Pacific, an entrance into this harbor. But, under the conditions which surround it, before anything like a fair competitive use of the harbor can be secured by other transportation interests it will, I apprehend, be necessary to work a change in the sort of human nature which usually dominates and controls competing business enterprises.

It is a serious question, too, whether under the provisions of the law the joint right of use provided for over the present approach of the Southern Pacific to its wharf could be used by any company which might desire to go beyond that wharf and build a wharf of its own, in as much as the law only provides for the equal sharing of "the pier now constructed on the site of said harbor and the approaches thereto."

The Board will notice that that provision is in the conjunctive. Where a matter of law involving the use of personal property and any invasion of it was under discussion, the courts would hold to a very strict construction of the wording of it.

I would not attempt to give this as a final opinion, but I am certainly of the opinion that the courts would hold to a very strict construction of the wording of it.

In the absence of such a right, and upon the failure of the Southern Pacific Company to fully occupy the protected area for wharves extending out from the right of way it might be possible for a competing railroad company to, at large expense, acquire by condemnation a very narrow right of way along the entire narrow approach to the harbor, and also through the land of Mr. Huntington, and so run a line into the harbor front to a point where it could put a wharf out in the area of the protected harbor. But such condition of affairs prohibits the construction and ownership of wharves by individuals or by an organization not endowed with the power of eminent domain for condemning lands. It is true that under the laws of California an individual or a company having obtained a franchise to construct and maintain a wharf can condemn a land approach to such wharf of sufficient dimensions to form a landing place for the wharf on the shore. But such individual or company has no power to condemn a highway for an outlet to the business of such wharf, and at the harbor in question it would be necessary for every person or corporation desiring to construct and use a wharf extending from that portion of the water front controlled by Mr. Huntington to secure in some way a control of the land lying between it and the railway right of way subject to joint use. It is difficult to see how this could be done, as the ownership of a franchise to construct and maintain a wharf conveys with it no power to condemn a way leading from it to any other point. I apprehend, however, that should the harbor be constructed at Santa Monica there would be no attempt at private ownership to wharves.

I am not advised as to the exact expenditures which the Southern Pacific found necessary in order to reach a practical depth of water at that point; but in his letter to Secretary Lamont—a copy of which is Document F of the typewritten documents filed by Mr. Cortell with this Board—Mr. Huntington, the president of the company, says: "We went to Port Los Angeles and built a great pier there which cost us, I think, about \$1,000,000."

I also notice that in the speech upon the merits of the proposed harbors, which I have referred to above, Senator Frye states that "the Southern Pacific planted \$1,000,000 in building at Santa Monica * * * the finest wharf or pier in the world." But however much or little the wharf may have cost, it is hardly probable that with the difficulties which might be interposed by the company now holding the superior right along the whole of that harbor in view, any private party or company will be induced to expend the very large amount of money necessary to build a wharf of over 4,000 feet long required to reach deep water at that point.

In addition to the foregoing, a most serious aspect of the case is the burden upon commerce which will be entailed by the necessity of obtaining a fair return upon the investment from the commerce passing over wharves costing in the first instance so

much to build, and in the second instance so much to maintain against the destructive insects which frequent the warm waters of the Pacific Coast. And it is not possible at that place to accommodate any sort of commerce, even the comparatively light-draft coasting lumber vessels, in any other way than upon a long and expensive wharf.

These conditions, I submit, are such as to make any railway company desiring to reach upon this coast a harbor which shall attract an extensive foreign and domestic commerce despair of accomplishing that end at Los Angeles, for the reason that it seems improbable that, under existing conditions, any commerce will be attracted to that port save such as can be secured by the company which has already the superior rights there. And it appears quite certain that what commerce may be induced to come there will be controlled by the Southern Pacific Company through the special privileges and concessions which that company will be enabled to offer it, and which no other company can hope to equal.

Taking the Southern Pacific's statements as to the cost of its own wharf, it is not going out of the way to say that the first cost of wharves necessary to be constructed in that harbor within the next ten years, should anything like a considerable business be developed there, will equal the cost of constructing the harbor itself, and this counts nothing for the enormous cost of maintaining such structures in the waters of this latitude.

But it is, I submit, not to be imagined that any considerable commerce can be enjoyed by a harbor offering no opportunities in the way of the construction of warehouses for the accommodation of such freights as can not be economically handled from the ships to the cars and vice versa, or for affording vessels such accommodations as they may require beyond the mere furnishing to them of a place to discharge their cargoes onto cars. It is not conceivable that any harbor that has, and can have, no provisions for docking, cleaning, and repairing ships can ever be more than a mere port of call.

Persons familiar with the harbor of San Francisco know that frequently vessels come to that port over the long distances from the ports of the Pacific islands and the Orient, buffeted and battered by the storms which they encounter, for whose accommodation such interior basins and docks are absolutely a necessity. It is impossible to see how such things could be afforded at the proposed harbor, and in their absence it will certainly never realize the destination as a harbor for a great national and international commerce which the conditions of competitive and cheap transcontinental railroad transportation heretofore adverted to would seem to prophesy as the future of a properly located and constructed harbor.

The fact that the Southern Pacific Company has expended a large amount of money in acquiring its present holdings at Port Los Angeles is dwelt on at some length in arguments and in documents filed with this Board, as some evidence of the fact that, in the opinion of this corporation, that location is the best upon this coast for a harbor.

My acquaintance with transportation conditions upon this coast leads me to believe that its actions in that respect are entitled to no such weight, and I think that a simple statement of the facts will demonstrate this.

Testimony has been submitted to the Board of the large commerce done at San Pedro when that was the only port for the city of Los Angeles. It has also been shown that that commerce, excepting as to certain articles handled by vessels which enter the inner harbor, has largely fallen off within the past few years.

I have already adverted to the construction of the wharf at Redondo and its connection with the city of Los Angeles by two lines of railway. It is a fact that at present the principal maritime commerce of this coast is between this city and San Francisco and way points.

The Redondo Wharf after it was open for commerce took from San Pedro about 62 per cent of this coast commerce to and from San Francisco. For reasons I have explained it also secured the larger part of the commerce brought to this part of the coast in deep-draft vessels around the Horn.

The entrance of the Los Angeles Terminal Railway into San Pedro in 1891 would divide with the Southern Pacific Company what remained of the coast commerce at that port. The Southern Pacific Company thus found itself suffering a loss of considerably more than half of the commerce which it had originally enjoyed at San Pedro and threatened with a loss of more.

By building its pier at Santa Monica that company has returned upon the Redondo people the trick which they served upon it with reference to the commerce in the direction of San Francisco, and it has at the same time continued its competition with the Los Angeles Terminal Railway at San Pedro for the important business which continues to come to that port. It has also the further advantage in the location of its Santa Monica Wharf that no wharf can be built westward of Port Los Angeles, for the reason that the topography of the country is such that no line of railway can ever reach Los Angeles beyond that point, and it will there always have

the first and last call on commerce to and from San Francisco. Furthermore, no other railroad company was likely to go to the large expense of building into that place and expending something like a million dollars in the construction of the costly wharf necessary to do business there for the purpose of merely dividing with the Southern Pacific Company the coast commerce which the location at that point attracts.

By building its pier at that place the Southern Pacific Company also secured a method of landing the immense quantities of coal which it uses upon its southern system, directly from the ship to the bunkers, instead of lightering it, as it had theretofore done at San Pedro, and also has provided a place where deep-draft vessels can unload their cargoes directly from the ship to the cars, an advantage enjoyed only by Redondo until the building of the wharf at Port Los Angeles. The advantages which the Southern Pacific Company thus gained, and will always retain, for handling the largest portion of the coast commerce in the direction of San Francisco, which commerce will of course increase greatly in the future, and in handling its coal will amply repay it for the investment which it has made at Santa Monica, without reference to the utilization of that port for the character of commerce intended to be accommodated by the harbor which it is proposed by the Government to construct on this coast. In addition to that, the possibility of using its Santa Monica improvements as a means of diverting the construction of the deep-water harbor from San Pedro, where it has to meet competing conditions, to Santa Monica, where it has superior rights which can never be overcome, was certainly worth a good deal.

In this connection I desire to quote to the Board from the speech made by Senator Perkins in the United States Senate when the bill carrying the appropriation for this deep-water harbor and providing for this Board was under discussion. It may not be improper, as an introduction to this, to say that Senator Perkins came to this coast some forty-five years ago as a sailor before the mast, and since that time has maintained an intimate acquaintance with the coast of California, first as a sailor and afterwards as a shipowner, and he is to-day a member of a firm owning the most extensive line of vessels plying upon this coast.

Senator Perkins says (speaking of the Southern Pacific Company): "They never seriously intended building a wharf outside (meaning the outer harbor at San Pedro) until the breakwater was completed, because they had ample facilities inside for the transportation of all the freight that came there. The great objection to it was lighterage. It was one of the great expenses that ships having a heavy draft of water, more than 18 feet, could not go in over the bar at Wilmington, and the result was that the ships were obliged to anchor in San Pedro Roadstead, and there lighter their coal on shore. So there was a rival wharf built at a place called Redondo, on the southern portion of Santa Monica Bay, and that wharf was getting a large amount of business that came from the north, because passengers and freight would reach Los Angeles City via Redondo several hours before they could on vessels coming from the north going via San Pedro. It was a wise business undertaking and it is characteristic of the enterprise and sagacity and business foresight of the management of that great railroad company. As I have said before, for his enterprise, for his energy, for his push Mr. Huntington is the peer of any man in this country. So he wisely said, 'We will build a wharf on this bay where we can save this lighterage.' Do you know that they use from 10,000 to 15,000 tons of coal per month that is obliged to go over their road to various distribution depots. So the railroad company decided to build this wharf at Santa Monica and save this \$1 a ton lighterage which was paid to another company. It was a wise business enterprise. It was not an experiment. . . . The wharf at Santa Monica, as I have said, has been a good business investment. I believe the saving alone to the Southern Pacific upon its lighterage of coal and lumber and other supplies will amount to not less than \$15,000 and perhaps \$20,000 per month, and by reason of their facilities for doing other business, for handling merchandise coming in over the wharves from other countries, as well as our own coast States, they can handle it much more cheaply than anybody else can, and this will correspondingly add to their revenue. Therefore the building of this wharf is a splendid business investment, and I do not believe that the projectors of the wharf when they built it had any expectation of asking the Government to build a breakwater."

I don't know of a person in California who, from his own intimate acquaintance with transportation matters upon this coast, is more competent to speak upon this point than is the Senator just quoted, and it would seem that what he says is so reasonable that it should dispose of the claim I have just been discussing.

In this speech of the Senator's are a number of matters gained from his knowledge and experience as a seaman and owner of vessels upon this coast with reference to the trend of currents, and especially this southeast wind at San Pedro. I believe there have been copies of his speech filed with the Board, which are in the copies of the Congressional Record filed. I desire, however, to file these copies which are segregated and where the matters may be more easily accessible to the Board.

Before passing this point, it may be appropriate to notice the claims advanced by

the advocates of the location at Port Los Angeles, founded upon the alleged greater nearness of that point to Los Angeles. A great deal has been made of this difference between Los Angeles and that point and San Pedro.

In a report which I have in my hand, issued by the Government, of a hearing had before the House Committee on Rivers and Harbors on February 28, 1896, of engineers advocating the superior advantages of Port Los Angeles for a deep-water harbor, Mr. Corthell is made to state: "Southern California, of which the city of Los Angeles is the center of population and trade, has increased in population, and similarly in all other directions, about 350 per cent in the last fifteen years, and Los Angeles is only 12 miles from Port Los Angeles, where it is proposed to build the breakwater and make a protected harbor."

I am under the impression that this document has been submitted to the Board, and I know that in the matter which has been submitted to it are statements with reference to relative distances between the city of Los Angeles and Port Los Angeles and San Pedro.

I will file with the Board a time and distance table for the Los Angeles division of the Southern Pacific Railroad system, by which it operates its trains, which will show that the distance between Los Angeles and San Pedro is placed at 22.10 miles; between Los Angeles and Port Los Angeles at 20.40 miles, being a difference in favor of Port Los Angeles of 1.70 miles, which difference would probably be increased a matter of 2 miles on all trains running from piers that might be constructed in the proposed outer harbor at San Pedro; a difference, it is unnecessary for me to say, so trifling as not to be considered in railroad transportation, and especially, as in this case, where it is more than compensated for by grades largely in favor of San Pedro, as has been shown this Board by the testimony of Mr. Hawgood.

I will say, too, that the Board have seen, from the peculiar formation of our town and the way it is developing, that already the distances between the corporate limit of the two towns may possibly be decreased materially in the future, but the distance as to all transportation is not likely to be changed at all. That will probably never be changed. Certainly the distances for the transportation of goods will remain the same.

There is also, it appears to me, another objection to the location of the harbor at Port Los Angeles, and which may in its ultimate results seriously impair the usefulness of any harbor located there. The Board will note that the map submitted to them shows that the narrow beach approach to Port Los Angeles extends for a considerable distance in front of the town of Santa Monica.

This is an incorporated city, and under the laws of the State of California no railroad can be constructed within the limits of a municipality in this State without the consent of its board of trustees or city council. It is quite within the power of the legislative body of this city to prohibit the widening of the approach to Port Los Angeles to more than the 50 feet now already held there by the Southern Pacific Company, should that body deem a further occupancy of its beach by railroads detrimental to the interests of the city. Indeed, if the present franchise of the Southern Pacific along its right of way fronting that town calls for a definite number of tracks, as one or two, that number can not be increased without the consent of the board of trustees of the city of Santa Monica.

We have a section of our law which says that no railroad track shall be built upon land or water in the limits of a city without the consent of the board of trustees.

The importance of this place has arisen from its being a very charming seaside resort, and largely the favorite resort of that kind for the citizens of Los Angeles and the surrounding country. It doesn't seem to me improbable to presume that the citizens of that town will soon find that the attractiveness of its beach, to which it is indebted for its prosperity and present importance, will be seriously impaired by an extension of the railroad use of the same. If that should become to be generally felt in that city, it is hardly probable that any other line of railroad will be built there without infinite trouble, if at all. Certainly, under the laws as they exist in this State, the use of the proposed harbor for commerce, except what can be carried over the present lines of the Southern Pacific aligning the water front of the town, will be absolutely at the mercy of the board of trustees of a seaside village—a condition of affairs of sufficient gravity to have induced Senator White to speak very earnestly about the matter, as will be shown by a perusal of his speech on the harbor question filed with this Board, which it seems to me would hardly encourage a large expenditure of Government funds at that place.

From the point of view of a railway company the advantages shown to be lacking at Santa Monica exist in full measure at San Pedro, and it is comparatively free from the disadvantages noted at Santa Monica.

Just here, with the indulgence of the Board, I desire to say a word as to what appears to me to be very plainly an error, made by Mr. Corthell in his address to you upon last Monday, in construing the force and effect of the law providing for the improvement of the inner harbor at San Pedro. After quoting certain extracts

from the speech of Senator Frye, and a letter in his possession, Mr. Corthell states as his conclusion: "That is, Congress was unwilling to do any more work at Wilmington on the inner harbor, if the outer harbor should be built at San Pedro, and facilities there for local commerce requiring deeper water than the present work has provided—13½ feet at low water—must be established in the outer harbor. In other words, they must abandon the inner harbor and move out."

The law from which Mr. Corthell deduced that conclusion reads as follows:

"For improving Wilmington Harbor, California, in accordance with the project submitted February seventh, eighteen hundred and ninety-five, fifty thousand dollars: *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three hundred and forty-two thousand dollars, exclusive of the amount herein appropriated [fifty thousand dollars]; but no such contracts shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and refuge as between Port Los Angeles and Santa Monica Bay and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor."

The project referred to in that law as "the project submitted February 7, 1895," is the project of Colonel Benyaud, for the attainment of 4 feet additional depth at the entrance to the inner harbor. (Executive Document No. 61 of the Fifty-third Congress, copies of which I believe have been filed with this Board.)

How it is possible to have deduced from the wording of this law any hostility of Congress to the inner harbor at San Pedro, any expression of unwillingness to do any more work at Wilmington in the inner harbor, any notice that the inner harbor must be abandoned and its occupants move out, is something which I have been unable to comprehend.

The appropriation to begin work remains undisturbed. It is an appropriation which can not be spent for the maintenance or other expenses of the harbor, but must be spent for commencing and prosecuting, as far as the same will go, the work on the inner harbor recommended in the project of Colonel Benyaud. It is, I submit, as plain a commitment of the Government to that work, as a whole, as can be made in words.

The simple fact is that the location of the deep-water harbor at San Pedro will, by the terms of the law, have the effect of taking what shall remain to be done of the work upon Colonel Benyaud's project, after the \$50,000 shall have been expended out of the continuing-contract system under which it would otherwise remain, and placing it under the annual appropriation system.

The reason for this change, and the way in which it came to be made, amply sustain this view of the law, if any support were needed.

Since Mr. Corthell, in support of his opinion, referred to his recollection of the facts concerning this matter, I trust that I may be permitted to advert to certain of them with which I happen to be personally acquainted, on account of having been present at Washington when the legislation in question was had.

The clause for the improvement of the inner harbor at San Pedro, above quoted, without, however, that part providing for the possible lapsing of the \$342,000 continuing-contract provision, was adopted by the Senate as an amendment to the river and harbor act as it came from the House, and was in the act in that form when the bill was sent to the conference committee. That part of the bill appropriating nearly \$3,000,000 for the deep-sea harbor was also added as a Senate amendment. When the matter came up for consideration in the conference committee the clause relating to the appropriation for the inner harbor was amended by the addition thereto of the words "but no such contract shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and of refuge as between Port Los Angeles in Santa Monica Bay and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor."

With that addition by the conference committee, the bill was reported to the House and Senate and passed. The records of Congress show this much. In addition to that, at the time the change was made by adding the words just quoted, I was informed by Senator White, of California, that in considering the matter the conference committee were of the opinion that, in view of the large amount carried by the river and harbor bill, being, as it was, about \$60,000,000—one of the largest river and harbor bills ever passed by Congress—and the depleted condition of the Treasury, it was thought that if it should be decided to spend the larger appropriation at San Pedro, the presence in the bill of the whole appropriation of \$392,000 for the inner harbor would appear to constitute, when taken together, too large a sum to be given to one place. It was therefore provided that in the event of the expenditure of the larger sum at San Pedro, the work upon the inner harbor project not paid for by the

\$50,000 should be taken off the continuing-contract system and left to be prosecuted by future appropriations as Congress should decide.

In view of this, it would appear that the entertainment of any anxiety as to the existence of a possible sentiment of opposition in Congress toward San Pedro's inner harbor, and especially the anticipation that the tenants of that harbor are in danger of being served with a notice from the Government to move out, is an entirely uncalled-for exercise of sympathetic anticipation.

The blue print filed with this Board by Mr. Hawgood, with the intention of showing the ownership of the water front upon the westerly side of the inner and proposed deep-water harbor at San Pedro, was made up from data collected from the public records of the county, and its correctness can be fully demonstrated if there is any disposition upon the part of anyone to question it. It shows such a diversity of ownership of the frontage of the inner harbor as to demonstrate, beyond a question, the absolute impossibility of any monopoly of its advantages, not counting the fact that the eastern water front of the inner harbor is also subject to other ownership. It will be noted that by that map the Southern Pacific Company is shown to own a considerable strip of land aligning that portion of the proposed outer harbor from which wharves can be most easily projected.

It has been claimed here that the Southern Pacific holdings on the water front of the proposed deep-water harbor at San Pedro tend to give that company a monopoly of its advantages. I think the inspection which this Board has already made of that location has probably shown you that the topography of the country west of the Southern Pacific holdings is such as not to offer any serious difficulties of approach by any other railway company that may desire to reach the harbor front by crossing the Southern Pacific track.

The mesa or high plain lying west of the proposed deep-water harbor and under the Palos Verdes Hill also affords several hundred acres of ground excellently adapted to the construction of warehouses and storage depots for any commerce which it may be necessary to handle to and from the deep-water harbor. As to the inner harbor, the opportunity afforded to shippers for securing these apparently necessary adjuncts to the commerce of a large seaport is practically unlimited.

In addition to that, another advantage entirely lacking at Santa Monica, and as to whose necessity in connection with such a harbor as it is desired to secure there can, it seems to me, be no two opinions, exists in perfect form at San Pedro. I mean the opportunity for docks and interior basins where ships may be placed for cleaning and repairing. The 18 feet of water over the bar at the present time would enable almost any vessel to go into the inner harbor after her cargo was discharged; and when that depth is increased to 22 feet by the completion of the Benyaard project, there would appear no reason why any ship of commerce which sails the ocean might not find inside all such accommodations for dockage and repair as could be needed after the longest or hardest voyage.

Reference has been made in what I have quoted from the report of the Board of 1892, and also in quotations which have been made to the Board from Senator Frye's speech, to the relation which the proposed harbor will sustain to the commerce coming through the Nicaragua Canal when that enterprise shall have been completed, as it is confidently hoped and believed through all the western portion of the United States will be done before many years. When that time arrives an immense commerce will undoubtedly come to this coast from the eastern coast, in vessels of comparatively light draft, constructed especially with reference to that service. It would not appear probable that any considerable percentage of this commerce will be done by vessels which could not enter the inner harbor at San Pedro, when the depth of 18 feet of water at mean low tide is secured by completion of the Benyaard project. With the accommodations which the location of the deep-water harbor at San Pedro, and the advantages which can be obtained there by the improvement of the inner harbor, would give to that commerce, and the distributing advantages offered for that commerce by the two lines of transcontinental railroads already in Los Angeles, and the third which will probably be secured as a connection with the Terminal before the canal is completed, it would appear that the port through which a large part of the Nicaragua Canal commerce will be distributed to that portion of the United States lying west of the Rocky Mountains, will be the port of San Pedro. That port will then, for that commerce, as compared with Port Los Angeles, enjoy any superiority in time between the seacoast and the city of Los Angeles that Port Los Angeles now enjoys with reference to the upcoast commerce to San Francisco, and the latter will certainly be much less important and worthy of accommodation than the commerce which we may expect through the Nicaragua Canal.

From the foregoing considerations, the corporation with which I am connected—and I think I may say every other railroad interest centering in this city save the Southern Pacific—feel that the interest of the railway lines now existing or hereafter to be built to this part of the coast requires the location of the proposed harbor at San Pedro, for the reasons, first, that it is infinitely more accessible for railroad

lines; second, that there is no such superior right owned there by another railroad company as would become very burdensome upon competing lines; third, because it affords, in the largest measure, accommodations for such commerce as is desirable to attract to such a harbor, and will therefore attract a larger commerce, of which railroad companies will have their share, than will the other proposed location.

Mr. HOOD. Mr. Gibbon, of course you heard Mr. Patterson's statement and my questions to him?

Mr. GIBBON. Yes, sir.

Mr. HOOD. And you heard his answers? It has struck me that perhaps your very interesting communication had been written before that.

Mr. GIBBON. Most of it had; yes, sir.

Mr. HOOD. Or you would have modified it. As it is in evidence and has taken some time, I am afraid I shall have to take a little more time myself asking you some questions. Your legal knowledge makes it very satisfactory to question you, because I will learn something on those points. Now, first, do I understand you to mean that the personal ownership or personal control of Mr. C. P. Huntington extends for a distance of about 2,200 feet?

Mr. GIBBON. A certificate of title which I have in my pocket from one of our abstract companies so tells me.

Mr. HOOD. You have also known me a long time, and my statement here carried some idea to you that that was the case?

Mr. GIBBON. Yes; but I had this long before I had your statement.

Mr. HOOD. Then, if that is the case, it is 2,200 feet. I got a general impression from your remarks that you thought he controlled nearly all of the 8,400 feet of protected frontage.

Mr. GIBBON. No; I want to modify that and did modify it. It appears there is a gap there which you don't own, and I desire to make a correction so as to exclude that part from any remarks I made.

Mr. HOOD. So that your second repetition of that statement in your remarks was inadvertent?

Mr. GIBBON. Inadvertent if I did make a second statement.

Mr. HOOD. So that really it is a little less than one-fourth of the proposed protected frontage?

Mr. GIBBON. Yes; if you count the protection to be at right angles with lines running out here, which I don't imagine is true, although I am not marine engineer enough to demonstrate its correctness; otherwise the maximum protection enjoyed would be about 4,400 feet on one side, all of which Mr. Huntington controls.

Mr. HOOD. That question is a difficult one, and has proved too difficult for any of the engineers who have testified here; so that I think we will have to take the frontage temporarily as the length of our breakwater. The breakwater is essentially 8,400 feet long. It comes down to opposite the westerly limits of the town of Santa Monica, as you will notice by the map. Now, Mr. Gibbon, why do you think that breakwater, as shown on the proposed plan and in Executive Document No. 41, and on which plan and document the Southern Pacific Wharf is shown with intended or probable accuracy, will better protect the Southern Pacific Wharf than the next one, two, three, four, or five wharves, in fact, six wharves to the eastward, when there is a southwest storm swell?

Mr. GIBBON. I don't believe I said so. I said it enjoyed the maximum protection, but that would not exclude the idea of one or more wharves enjoying the same.

Mr. HOOD. Then you don't mean it would enjoy more protection than any other wharf?

Mr. GIBBON. No, sir; I don't know how close together you have put those wharves. I should say it is about 1,500 feet, approximately. I should imagine that the wharf here would enjoy as much protection as this one would here [showing on map], but certainly not that one.

Mr. HOOD. I wish to get your idea, because it was to me obscure.

Mr. GIBBON. I stated in one place that there were 4,400 feet enjoying the maximum protection. That, according to my idea, would be correct.

Mr. HOOD. Then you do think other wharves could be built and be as much protected as this wharf?

Mr. GIBBON. One on that side, and one on the westerly side, probably. I believe, from my knowledge of that locality, and from my general knowledge, being acquainted with the seacoast here in sailing over it on fishing excursions, that you are going to have a lot of trouble when you get your southwest wind anywhere from along there over [showing on map], because the testimony of those mariners, and the testimony of Senator Perkins in his speech, is that the southeast wind blows hardest when it gets to the southwest, and that brings an element into the end of your proposed breakwater, if I understand the direction.

Mr. HOOD. Of course, you understand that a breakwater would somewhat change the condition?

Mr. GIBBON. Yes, sir; but not the course of the wind.

Mr. HOOD. Not a bit, but the course of the waves.

Mr. GIBBON. Not the course of the waves, except where they struck the breakwater.

Mr. HOOD. You have not heard anyone speak of the breakwater as a structure to break wind, have you?

Mr. GIBBON. No, sir; but where the wind has a sweep there I don't see how the breakwater could change the waves.

Mr. HOOD. What I was trying to get at is this. You do think, do you not, that other wharves could be built behind the proposed breakwater?

Mr. GIBBON. At least one could, Mr. Hood. I certainly think it could, taking the distance between them at 1,500 feet.

Mr. HOOD. And perhaps more?

Mr. GIBBON. I would hardly be willing if I were going to put money in a wharf to build it closer than that.

Mr. HOOD. You think the next four piers east of Port Los Angeles Wharf would be as well protected as Port Los Angeles Wharf?

Mr. GIBBON. Do you mean these piers here [indicating on map]?

Mr. HOOD. Yes.

Mr. GIBBON. Yes, sir; I do. I think those would also enjoy the maximum of protection.

Mr. HOOD. We have corrected all those impressions very nicely. I will ask you now in reference to a telegram you mentioned from myself to Senator Frye.

Mr. GIBBON. I didn't say it was from you.

Mr. HOOD. I think you mentioned it as though the principal feature of that telegram was its reference to the holding ground at San Pedro.

Mr. GIBBON. I don't know that it was. I saw the telegram at the time, and saw it once afterwards; but the telegram had been lost. I know this, that when Senator Frye presented it he referred to the fact which I mentioned, and he has never made a speech on that matter that he has not dwelt upon it since. I would also say that the Board which was appointed after that telegram was received made a severe investigation here of the question of holding ground, as you know; and as the appendix to their report will show, they were governed very largely by that investigation.

Mr. HOOD. Of course you are aware that Coast Survey charts say "rocky bottom" very frequently in San Pedro Bay? It is marked "rocky."

Mr. GIBBON. Yes, sir.

Mr. HOOD. And that those rocky places are generally accompanied by marks of "kelp bed" there?

Mr. GIBBON. Yes, sir.

Mr. HOOD. You are probably aware also that for many years it has been considered that kelp was an indication of the presence of rock?

Mr. GIBBON. Yes, sir.

Mr. HOOD. Did you ever notice that my telegram at that time called attention to the rocky bottom as indicated by the Coast Survey chart?

Mr. GIBBON. No; my recollection of the full text of it is not sufficiently accurate for me to say. I have no copy of it. I have in my hand a copy of communication dated May 11, which was two or three months after the date, from yourself, in which this expression was used: "The anchorage in the protected area is very poor holding ground from the character of the bottom, and vessels would have to run to sea from southerly gales when they could no longer hold to a wharf safely."

Mr. HOOD. I wish to ask you, Mr. Gibbon, if examining the Coast Survey charts, you would not have said there was a good deal of rocky bottom in San Pedro Bay?

Mr. GIBBON. That is a question I would not want to answer. From my knowledge of the bay personally (and I have gone over every square hundred yards of it at different times), I would say from the presence of kelp that there is some rock in it, but I would not say the anchorage was poor on that account.

Mr. HOOD. I was simply leading you up to what I know or imagine you will say.

Mr. GIBBON. I have no criticism to make. I am positive of this, however, because I have talked with Senator Frye, that that one statement has had more to do with the opposition which has been manifested in Congress toward San Pedro among certain parties than everything else that ever has been done, and I think I can refer to his speeches to show that that was always in his mind.

Mr. HOOD. Speaking of accretions to the shore—filling up from mean high-water line, and such filling out becoming the property of the shore owner—now, is such property subject to condemnation for public use, such as the use of a railroad company?

Mr. GIBBON. Yes; undoubtedly.

Mr. HOOD. Then does it in anyway differ from a town lot in San Pedro that it is necessary for a railroad corporation to use?

Mr. GIBBON. No, sir; not at all. I was speaking of that with reference to its use for warehouses.

Mr. HOOD. Do you not think that a railroad company can condemn a situation such as this not only for right of way for a track, but necessary ground for business facilities, such as sidings, yards, warehouses, and anything at all?

Mr. GIBBON. Yes, sir; if it has not been occupied by other companies for that purpose, they could undoubtedly do it at what might be a considerable cost.

Mr. HOOD. You will excuse me for getting so much legal advice free of charge.

Mr. GIBBON. It may be worth about as much as the legal advice one gets free of charge generally is.

Mr. HOOD. Allow me to say that I have not the slightest doubt but that any advice I get from you will be excellent, and I will try to reciprocate sometime.

Mr. GIBBON. Of course after that I will try to do the best I can.

Mr. HOOD. Speaking of the obstruction other railroads would meet with in gaining access to the harbor on account of Santa Monica Heights tract and private ownership, I think you stated the land between the Southern Pacific right of way which is close to the bluff and high tide, was owned by Jones and Baker, or something of that kind?

Mr. GIBBON. Yes.

Mr. HOOD. Have you any possible reason why another corporation could not acquire that land of Jones and Baker by purchase or condemnation?

Mr. GIBBON. No, Mr. Hood; my great objection as a railroad man to that is this: Of course it will go without saying that this Santa Monica Heights tract will be used for the benefit of the Southern Pacific Railroad. For the sake of argument, I will concede you all the power of condemnation you require on land that has not been used by railroad companies. We have under the laws of this State the right to condemn and cross a railroad company's line, and I apprehend we could condemn an unused portion of a right of way, but there is no way by which a railroad can condemn laterally along another company. If I were at the head of your company and wanted to shut out commerce, I would acquire from Mr. Huntington this tract of land and cover that land so thoroughly with railroad tracks that there would be no chance of another company placing a track there, and in that way prevent a railroad from entering.

Mr. HOOD. Of course you would have to have more money than we have now.

Mr. GIBBON. Oh, no; Mr. Huntington says they can build tracks there for \$10,000 a mile.

Mr. HOOD. You get off from my question a little. I was asking whether there was any possible or probable difficulty in other railroads getting control of such lands as are owned by Jones and Baker between the Santa Monica Tunnel and the Santa Monica Heights tract, as they might have use for them.

Mr. GIBBON. No, sir; I should say not, except that the cost of condemnation might be considerable. That is the difficulty and trouble. But suppose they could do it. That brings them to the outer area of that unprotected harbor, and that is all. They go down there for the purpose of doing business on a circumscribed area.

Mr. HOOD. It brings them into about the eastern two-thirds.

Mr. GIBBON. I believe you stated it was 8,400 feet, didn't you?

Mr. HOOD. Yes, sir.

Mr. GIBBON. Isn't your wharf situated about the center?

Mr. HOOD. No, sir.

Mr. GIBBON. I don't think it varies 100 feet from being in the center. It is very close to it.

Mr. HOOD. Center of what?

Mr. GIBBON. Of the protected area.

Mr. HOOD. Do you think so?

Mr. GIBBON. I am taking that map for it. The distances are so small on that map that the eye would err 100 feet one way or the other, but I think it is very close to the center.

Mr. HOOD. As we are getting into engineering questions, I will only remark that the center of the protected area would be somewhat governed by the direction of the prevailing swell.

Mr. GIBBON. I notice in the plans of 1892 the little dotted lines outlining the center run at right angles with this here [showing on map]. They run at right angles with that.

Mr. HOOD. I need only say that you probably remember, do you not, that I have never been exactly in harmony with the Board of 1892?

Mr. GIBBON. Certainly not as to location. I don't know anything about the details.

Mr. HOOD. Now, you spoke of the obstruction which the city or town of Santa Monica, whatever it is, might put in the way of other railroads running between the present Southern Pacific Railroad and the high-tide line of the beach.

Mr. GIBBON. Yes, sir.

Mr. HOOD. Now, do you mean to make the statement, as a lawyer, that a corporation can not condemn or purchase private property across which there are no streets and build anything at all on it that is not a menace to life?

Mr. GIBBON. There is a section in our code under the title of railways which says that no land or water in the limits of any municipal corporation shall be used by a railroad company without permission of the municipal corporation. It is as broad as language can make it. I have not been able to find that there has ever been any decision limiting that.

Mr. HOOD. That is what I am getting at. Has that been ruled upon?

Mr. GIBBON. I don't think it has. But certainly if it were ruled on and were in anywise reduced from the broad construction which I have given it here, it would be done by limiting the expression and not by giving it its full force, because the expression is as broad as language can make it.

Mr. HOOD. You refer to the Supreme Court, I suppose.

Mr. GIBBON. Yes, sir.

Mr. HOOD. What do you think they would rule?

Mr. GIBBON. I should imagine they would rule that it was a question of policy left to the legislative body of a town as to whether a dangerous agency should be established upon public or private property in those limits.

Mr. HOOD. You do not imagine it would be ruled that it was another instance of the absurd use of language by legislators?

Mr. GIBBON. It might. There are a number of instances of that every year.

Mr. HOOD. Are you aware, as a matter of fact, without reference to legal decisions, that it is common for railroad corporations to put anything on land they own or buy in city limits—anything at all—that does not conflict with the city fire limits?

Mr. GIBBON. Yes, sir; that is true. Of course, that raises another question which I am not going to decide here, but about which I have my opinion; and that is the extension of private ownership on that beach which has been used for many years by the people. I apprehend that that use has been so general that it would establish a general ownership.

Mr. HOOD. Then your idea is that we have no right of way in that same distance?

Mr. GIBBON. Yes, sir; you certainly have.

Mr. HOOD. Why should not the proposed public control that you mention affect the Southern Pacific Company as well as any other company?

Mr. GIBBON. It might, unless you are there by permission.

Mr. HOOD. Where?

Mr. GIBBON. Then, of course, that settles it.

Mr. HOOD. Why do you think the people of Santa Monica should desire that their place should not grow up and become prosperous?

Mr. GIBBON. I am taking the view of some men of very good judgment on that, and that is this: That, as I stated, the importance of Santa Monica has been heretofore, and probably its future importance will be, its charm as a seaside resort. I do not believe, and I do not believe the majority of the people of Santa Monica believe, that the development of what commerce can be developed at Port Los Angeles, 2½ miles away, will be sufficient advantage to compensate for the loss they will surely sustain if their beach, the most attractive in southern California, is marred by railroad tracks. I could quote many people of Santa Monica on that subject, among them Mr. Abbott Kinney, who sold Mr. Huntington the Santa Monica Heights tract. I think I ought to say right here, since the statement was made to the Board, that this question of real estate has a good deal to do with the matter; that a very small per cent of the property at San Pedro is owned outside of that town, while I presume there are hundreds of inhabitants in the city of Los Angeles who have holdings at Santa Monica in the way of seaside homes.

Mr. HOOD. I understand you are giving your opinion, and that opinion is somewhat of a prophetic nature; not anything you know.

Mr. GIBBON. It is a matter that was of importance enough to engage the earnest attention of the profound ability of Senator White, whom I regard as one of the greatest lawyers in the State of California.

Mr. HOOD. We are all acquainted with Senator White's profound ability. I think I may ask this question: Has San Pedro the same control over its streets and lands in every way that Santa Monica has?

Mr. GIBBON. Yes, sir.

Mr. HOOD. In every way?

Mr. GIBBON. Yes, sir; I presume so. I don't know any different law applying to San Pedro.

Mr. HOOD. Then the remark you made about Santa Monica you would now wish to say applies to San Pedro?

Mr. GIBBON. Yes, sir; with the addition that San Pedro is built upon commercial matters, and its future depends upon assisting in the broadest way its development, while Santa Monica is entirely different. It is a seaside resort.

Mr. HOOD. It is a question, then, as to which town would be the most favorable toward the railroads that would want to build across its streets?

Mr. GIBBON. Yes, sir; undoubtedly.

Mr. HOOD. They both have the same power?

Mr. GIBBON. Undoubtedly.

Mr. HOOD. Now, in reference to grade system. Did I understand you to say that the Santa Fe has a less grade system to the east than what you call the northern route?

Mr. GIBBON. That was an expression read from the Board of 1892.

Mr. HOOD. What did it mean?

Mr. GIBBON. It meant what it said, I presume. I am not responsible for it. It is a statement which they made.

Mr. HOOD. Will you kindly read it again?

Mr. GIBBON. I can refer you to it if you desire; yes, sir. I think the remark applies more to the Southern Pacific than it does to the Santa Fe; but my knowledge of those two roads is not sufficient to enable me to say whether it is true or not.

Mr. HOOD. I would like to be informed on that point; it struck me as a novelty.

Mr. GIBBON (reading). "Two through lines, the Southern Pacific and Santa Fe systems, cross the continent at Los Angeles at much lower elevations than the northern lines, and also connect the Pacific Coast with the Gulf of Mexico." This is the Board of 1892 speaking.

Mr. HOOD. I don't know that there is any use of my questioning you if that is all you know about it.

Mr. GIBBON. There is no use of your questioning me. I stated that that was taken from the report of the Board.

Mr. HOOD. Then I won't trouble you especially. If anything of that kind cuts any figure in this matter, of course the Board will investigate for themselves. Did you also intimate that if the Terminal Railway, which you represent, built to Salt Lake on that short route, to the coal and iron and some such other things, that the grades of that road would be lower?

Mr. GIBBON. I didn't say anything about the grades of that road. The nearness of that route was dwelt upon, but not the grades.

Mr. HOOD. You said it was about how far?

Mr. GIBBON. I think 300 miles is the best statement or approximation of it that I have been able to get.

Mr. HOOD. I am asking this more for information.

Mr. GIBBON. Well, for that I depend upon someone else, because I never surveyed it or had it surveyed. I think you will find it is a considerable distance shorter.

Mr. HOOD. You mentioned that there was nothing in the law or act making the appropriation for the outer harbor which intimates that the present Wilmington inner harbor was to be abandoned?

Mr. GIBBON. No, sir.

Mr. HOOD. Have you heard anybody else intimate that the Wilmington Harbor in its present condition was to be abandoned?

Mr. GIBBON. No; except from Mr. Corthell.

Mr. HOOD. Did you hear it from Mr. Corthell?

Mr. GIBBON. I heard Mr. Corthell say it was a notice to move out.

Mr. CORTHELL. I would like to be quoted right there. It was for any additional facilities the larger facilities would have to move out.

Mr. GIBBON. At the same time the bill he was criticising carries with it a \$50,000 appropriation to make the inner harbor deeper.

Mr. HOOD. Then there was no intimation that the present inner harbor would have to be abandoned or that there was to be no further appropriation for continuing it in its present usefulness.

Mr. GIBBON. Inasmuch as I quoted Mr. Corthell's statement verbatim there can be no complaint against me. They can construe the language as they like.

Mr. HOOD. Don't you think it would be better to quote the entire context?

Mr. GIBBON. If I did I would say there was a spirit of opposition to Wilmington Harbor in Congress.

Mr. HOOD. I don't think there is any objection to quoting the entire environment.

Mr. GIBBON. That was a deduction which he read from Senator Frye's speech and letter. It was accompanied by a remark from Mr. Corthell that the spirit of opposition in Congress to the inner harbor boded no good to that harbor.

Mr. HOOD. That seems to be a matter between you and Mr. Corthell. I want to ask you another thing. You were speaking of the easy access to the outer harbor from the west. You meant north or northwest, didn't you?

Mr. GIBBON. Well, I possibly don't get the map just exactly right, but it is from this mesa land that comes up here [showing on map].

Mr. HOOD. You mean across the yellow tract to the north?

Mr. GIBBON. Yes, sir; north or west. It is really, as I understand it, almost west or northwest.

Mr. HOOD. Now, that is very easy, but have you any idea that the people that own not only the yellow tract, which I will drop the discussion of temporarily, but we

will say the remaining tract, which is largely owned by some Southern Pacific people—do you imagine the other land owners will be any more anxious to give up without proper compensation than Senator Jones would?

Mr. GIBBON. I don't think so. However, the railroad company that would secure every foot of ownership Senator Jones had would not have enough ground to maneuver on in doing the commerce of an important point. Here you have several hundred acres, I said; in fact you have several thousand acres which are practicable for railroads to use. The opportunity is so much greater. The trouble about it at Santa Monica is that there is so small a tract of land that can be used for railroad purposes.

Mr. HOOD. How many miles of track is there room for between Senator Jones's bath house and Santa Monica Canyon?

Mr. GIBBON. I believe the statement has been made by your company that there is room for something like 10 tracks, but that is not by any means all that is required for properly handling the freights of a harbor lined with railroad tracks. It is a very necessary thing, but only one of them.

Mr. HOOD. How many miles of track do you think that would be?

Mr. GIBBON. I have not an idea. I am perfectly willing to concede for the purpose of the argument that you might get all the rails down you require. The tracks of a railroad company are only one factor in the bringing together of land and water. After you get your tracks laid, do you suppose you have completed the link by laying the tracks alone?

Mr. HOOD. I think anyone familiar with the localities can answer the question to suit their own cast of mind in that matter. Now, I think you made rather a general statement which implied that the cost of wharves at Port Los Angeles would be greater than the cost of wharves at San Pedro. Did I understand you rightly?

Mr. GIBBON. I said that the cost of wharves for any considerable commerce that was developed there would be as much as the cost of the breakwater, and certainly if these two wharves approximate anything like the cost given for the one that has already been built it would be as much, not counting the maintenance of the wharves. That was all I said about the cost of wharves.

Mr. HOOD. Did I understand you to imply that it would be cheaper at San Pedro to furnish corresponding facilities than it would at Port Los Angeles?

Mr. GIBBON. I don't think I said so, but I certainly think so.

Mr. HOOD. Now, I would like the reason.

Mr. GIBBON. In the first place you can't get an 18-foot ship up to your place without building 2,000 feet of wharf. You can get them up here in the inner harbor without building hardly any distance. You only have to build 30 or 40 feet. I believe your wharf is 4,500 feet long, isn't it?

Mr. HOOD. Something like that.

Mr. GIBBON. I believe the coast soundings show that as the 5-fathom line [showing on map]?

Mr. HOOD. The 5-fathom line is at the shore end of the business portion of the wharf.

Mr. GIBBON. The 5-fathom line comes here [showing on map], within about 2,000 feet of the shore.

Mr. HOOD. At what point?

Mr. GIBBON. Pretty close down here [showing on map]; just about where you gentlemen started your wharf, a little more than 2,000 feet, probably.

Mr. HOOD. Now, how far does it come from the shore opposite the easterly end of the proposed breakwater?

Mr. GIBBON. Over here [showing on map]?

Mr. HOOD. Yes.

Mr. GIBBON. I should say six or seven thousand feet, probably, but I apprehend that a couple of wharves out there [showing on map] would be all you would need.

Mr. HOOD. Then I understand you to say that you did not compare the two proposed alternative outer harbors at all in reference to cost of wharves?

Mr. GIBBON. No; I didn't say anything about it in what I had the pleasure to read to the Board. I believe I did speak about the cost of wharves necessary to do lumber business here, as compared with the comparatively little cost here [showing on map].

Mr. HOOD. Then you had no reference to the two outer harbors as compared in themselves?

Mr. GIBBON. No, sir; that is a matter I prefer to leave to the engineering talent.

Mr. HOOD. You made reference to docks for the repair of deep-sea vessels in the outer harbor?

Mr. GIBBON. No.

Mr. HOOD. You have left that entirely out?

Mr. GIBBON. I said the place for docks would be in the inner harbor, and I said I thought it could be used by any vessel that would come to this coast.

Mr. MORISON. What do you mean by "docks?"

Mr. GIBBON. I mean docks for repair purposes.

Mr. MORISON. Dry docks?

Mr. GIBBON. Dry docks.

Mr. HOOD. You made some mention of the Southern Pacific Company starting a wharf?

Mr. GIBBON. Yes, sir.

Mr. HOOD. Did I understand you in your address to intimate anything as to our not having a distinct purpose to build a wharf and use it when we commenced?

Mr. GIBBON. No; I did not. Senator Perkins says, in what I quoted from his speech, that he did not believe it was the intention of the company to finish that wharf—I believe that was the sense of it—until the breakwater was completed, but that is simply taken from the Senator and goes for what it is worth.

Mr. HOOD. You do not indorse anything of that kind?

Mr. GIBBON. No; I think the wharf would undoubtedly have been completed if it had not been for the fact of the intervention of Redondo Beach made it more desirable to build it where you could accomplish the same purpose, and at the same time anticipate that 60 per cent of the coast commerce.

Mr. HOOD. That would be correct to a certain extent.

Mr. GIBBON. That would have been my reason.

Mr. HOOD. But you are also aware that I stated that I found a very great difficulty at that point, with reference to constructing a wharf in such a way, until the breakwater was finished.

Mr. GIBBON. I didn't probably notice that statement. There was a part of it I did not hear.

Mr. HOOD. You spoke about placing improvements west of the present Port Los Angeles Wharf, where it was practically impossible for another railroad, should it desire, to do so. Now, that struck me as curious, because I did not see at first why another railroad should wish to.

Mr. GIBBON. There is no reason, if it were an entirely approachable coast all along here and be on Point Dume, that some future railroad might come in, and, anticipating the coast business there, play the same trick you played at Redondo.

Mr. HOOD. It would develop into a race. I think we would be very little behind.

Mr. GIBBON. I haven't any doubt of that in the world.

Mr. HOOD. As a matter of fact, supposing we did not choose to do so, and it became necessary for another corporation to get by that Santa Monica Heights tract; do you think there is any very insuperable object there?

Mr. GIBBON. No; I do not, if you don't care to count the cost.

Mr. HOOD. If you do not care to count the cost, is it a very difficult thing?

Mr. GIBBON. The cost is the principal obstacle to overcome. I do not believe that under this law of joint ownership any railroad company can ever go by your wharf. Under this law of joint ownership, I believe the conjunctive form in which it is used, that they can not use your track without using your wharf also. That is merely my construction of the law.

Mr. HOOD. I am not attempting to construe the law. I do not mean that a portion of the Santa Monica Heights tract could not be condemned.

Mr. GIBBON. Unless you should occupy the whole front of it; but if you did, I don't know any law in California that would apply.

Mr. HOOD. Could not another company condemn a portion of the Santa Monica Heights tract adjacent to and along the Southern Pacific right of way?

Mr. GIBBON. Yes, undoubtedly could, unless the company's approach occupied the whole area.

Mr. HOOD. What whole area?

Mr. GIBBON. You know nearly all of that now has a right of way, and if Mr. Huntington would simply buy in what remained over the hills from the right of the pass, or extend in to high tide, and then you should occupy that whole 22 feet as thick as could be with railroad tracks, I do not know of any law in this State that could be applied to it. I should do it if I were in your place, and had a railroad company there that I wanted to keep a line from passing along.

Mr. HOOD. Supposing that your company, for instance, or another company, putting it more broadly, wished to convey a strip of land shoreward from the present right of way of the Southern Pacific Railroad Company at the Santa Monica Heights tract; I suppose you know that would be condemning a pretty high bluff?

Mr. GIBBON. Yes; 175 feet high.

Mr. HOOD. Do you know what they would do it with? One hundred and seventy-five feet high at the lower end, and I think about 182 feet high at the westerly end.

Mr. GIBBON. That is worse than I thought it was.

Mr. HOOD. About 7 feet. Now, that could be condemned, could it not?

Mr. GIBBON. That maintain?

Mr. HOOD. Yes, sir.

Mr. GIBBON. Yes; I presume so.

Mr. HOOD. Would it be very difficult to get a railroad under that mountain if a railroad wished to go westerly up the coast? Have you any idea of that?

Mr. GIBBON. Yes; I should say there would be considerable difficulty.

Mr. HOOD. What do you mean by that?

Mr. GIBBON. I mean in several ways. It would cost a great deal. The purchase would cost a good deal, and you certainly would be confined to one or two lines. If you attempted to extend your line area at all it would be done at such enormous expense that any company to undertake to make such an approach as that would find it almost absolutely impossible to do it.

Mr. HOOD. Have you any idea how much it would cost to tunnel Santa Monica Heights tract?

Mr. GIBBON. No; I have not.

Mr. HOOD. Why do you express such a positive opinion about that?

Mr. GIBBON. I know that probably the most costly part of railroad construction is tunneling, where they have to go into the ground. I know it is very much more costly to build a railroad that way than it is to build on an open, level place; and any company that has to have this vast cost, besides the cost of maintaining, would be so dreadfully handicapped as against the advantages which you now have there, that they could not afford to do that possibly. I don't know whether it would cost five or ten times as much to build your line along here, but I know it would be several hundred per cent in excess of what it otherwise would be.

Mr. MORGAN. Where would the line pass in as you are considering it?

Mr. GIBBON. That I do not know, Mr. Morgan. I presume it would pass in wherever the party building it had to stop running on the beach. If the obstruction which I just imagine were placed here, it would be, as nearly as I can approximate it now, about four or five hundred feet beyond the end of this breakwater where they would have to pass in.

Mr. MORGAN. Do you consider that tunnel an arbitrary point in reaching the harbor necessary?

Mr. GIBBON. It would be necessary, as Mr. Hood just supposed, if they had occupied all the available land outside the bluff in the way I suggested, so as to prevent the operation of the law of condemnation and eminent domain.

Mr. MORGAN. Then do you think there would be no other way of reaching that harbor, supposing it to be established there, because of that arbitrary position of the company?

Mr. GIBBON. I do not see any practicable way—no, sir—that I have ever known of. There has been something said about Santa Monica Canyon. From somewhat of a personal acquaintance which I have with that, but very much more from expressions which I have heard from persons whom I regard as competent engineers, that would make a very expensive and difficult approach; so expensive indeed, that that very fact would handicap any company going in there. But you will notice that the Santa Monica Heights tract, which constitutes the difficulty that I am discussing with Mr. Hood now, lies between the Santa Monica Canyon and the larger part of the protected harbor; so, if it even would get down to Santa Monica, it would not relieve the difficulty which I am talking about.

Mr. MORGAN. You spoke of the general necessity—the public necessity—somewhat separated from that of the railroad you represent and the one Mr. Hood represents; the subdivision of the property and the facilities that may be afforded by either harbor—the public benefit generally considered—and you gave as one reason the cost of the construction of the piers that would extend out into the harbor.

Mr. GIBBON. Yes, sir.

Mr. MORGAN. Now, would you, in your view of that matter, consider it essential that the bulkhead of each pier should be on the same line?

Mr. GIBBON. Do you mean the same fathom line?

Mr. MORGAN. The same line; yes.

Mr. GIBBON. No, sir.

Mr. MORGAN. The construction then might take place, as is ordinarily the case in all harbors, at a regular line—short and long piers, expensive and comparatively inexpensive piers?

Mr. GIBBON. Yes.

Mr. MORGAN. And the ground filled in?

Mr. GIBBON. I think, if you will permit me, I can illustrate my meaning if I may look at a copy of this report of 1892. Now, if you will notice where that line comes. It will require for a wharf to accommodate lumber schooners there the building out of nearly 3,000 feet. That means that 3,000 feet of wharf be constructed and 3,000 feet of piles to be destroyed by the teredo and limnoria on this coast.

Mr. MORGAN. I just want a general idea in regard to the construction, comparing the public interest outside of the strictly speaking railroad interest.

Mr. GIBBON. Mr. Hooper gave the Board a better illustration of that than I could give them possibly.

Mr. HOOD. Mr. Gibbon, really, then, to make it short, your expression with reference to putting a wharf down at Point Dume, Kellers Shelter, and some of those places, was entirely without any definite figures as to money in your head?

Mr. GIBBON. No, Mr. Hood, I can not say that. I don't think money would cut any figure in getting through those mountains. I think it would bankrupt almost any railroad. But the distance from here to here is not so much as to attract attention, and you gentlemen would still have the same advantage there. I never saw a position better entrenched, I don't think, in my life.

Mr. HOOD. But the fact is that I did not think you would express such an opinion without being backed by figures. Now, I could express an opinion if I were retained to do so.

Mr. GIBBON. I would not undertake, if I were to see a chain of mountains off here and some one asked me if I preferred to go there with a railroad or go on a plain—I would not sit down to figure out the cost of making a tunnel through those mountains, but would say at once that it would be cheaper to go on the plain.

Mr. HOOD. Always go on the plain if you can. Now, about the cost of a wharf at Port Los Angeles and this matter of Mr. Huntington's statements as to its cost. Did he state definitely that it would cost any given figure at all?

Mr. GIBBON. If you will allow me to have the copy of Mr. Huntington's letter I will read exactly what he does say.

Mr. HOOD. I would like to know what it costs myself.

Mr. GIBBON. If the president of your corporation does not know it, I don't know who you would go to for knowledge of that fact. The words that I quoted from Mr. Huntington's letter, and this is a copy of his letter here filed by Mr. Corthell: "After examining the whole situation I went to Port Los Angeles, and built a wharf there which cost us, I think, about \$1,000,000." That goes for what it is worth before the Board. I am not defending his opinion in any sense.

Mr. HOOD. You will notice it is a statement made without any data, and we know that he had very large interests, and if before he would certify to any figures of cost of construction I think he would have asked me.

Mr. GIBBON. Well, I probably should have asked you, but I had his statement before, and if it is not correct you could correct it.

Mr. HOOD. Why did you think we had no thought of a breakwater at Santa Monica when we built the Port Los Angeles Wharf?

Mr. GIBBON. Well, Mr. Hood, that is purely an expression of opinion from Senator Perkins, who, I believe, is infinitely better able to give an opinion on that matter on account of the close alliance which exists between his steamship and your company than I am.

Mr. HOOD. That is another question I will ask Senator Perkins.

Mr. GIBBON. That is what Senator Perkins quoted and it appears in quotation marks.

Mr. HOOD. I will ask him the next time I see him. Now, I wanted to ask you further: I would like you to say with reference to the land map that we filed at Santa Monica with explanations accompanying it?

Mr. GIBBON. Do you mean to make the change in reference to that?

Mr. HOOD. No. I would like to ask if, in your opinion, the land map that we have filed at Santa Monica, including my statement of the personal ownership, and the land map you have filed at San Pedro, including my statements, and possibly in that there were sundry private wharf franchises included, isn't it, so far as you know, correct, and a little more correct than your map filed at Santa Monica on the point I called your attention to, that not showing all that we own?

Mr. GIBBON. Yes. I will say to the Board that one of the chief reasons for filing that map was because I had a very carefully drawn tide line. The point I desired to make about riparian ownership. It had on it a water front, prepared of course before I knew you were going to file a map.

Mr. HOOD. We are in harmony on the line in substance?

Mr. GIBBON. I think so. I have no criticism to make at all.

Mr. HOOD. Excepting that your draftsman interpolated the tide below the Southern Pacific Railroad Company at the mouth of the Santa Monica Canyon?

Mr. GIBBON. Yes, sir.

The CHAIRMAN. Mr. Hood, Santa Monica has the floor now in rebuttal.

Mr. HOOD. Mr. Corthell will appear first for Santa Monica in rebuttal.

The CHAIRMAN. Mr. Corthell, in starting in rebuttal, I will call your attention to the fact that new evidence is not admissible.

Mr. CORTHELL. But evidence that is in rebuttal of evidence is admissible?

The CHAIRMAN. Anything that is necessary to rebut anything that the other side has produced is of course admissible.

Mr. CORTHELL. We wish to introduce a witness here in rebuttal of four or five points on which evidence has been given by the opposing side. That is admissible. Mr. Chairman, this is Captain Salmond, the master of the steamship *Wellington*,

who will give some evidence as a navigator in reference to the points that have been brought up by the opposing side. With your permission, I will ask Captain Salmond some questions in order to bring out his experience, as it may help him a little.

Mr. MOORE. I would like to ask whether the production of additional witnesses is within the scope of your ruling?

The CHAIRMAN. They have a right to introduce witnesses to show that any evidence which you introduced was an error, but they have no right to start on their own hook with new evidence.

Mr. CORTHELL. Captain Salmond, give your name to the chairman and members of the Board.

Mr. SALMOND. Colin Salmond.

Mr. GIBBON. I suggest that the parties examining the witnesses be permitted to ask questions directly to the point; that will inform the Board whether or not it is rebuttal, and at the same time conduce to getting the evidence in.

The CHAIRMAN. Mr. Corthell, before you begin, will you be kind enough to state what it is you want to rebut, and then follow with your questions?

Mr. CORTHELL. Yes, sir. We propose to rebut by this testimony, first, some testimony given by Mr. Moore in reference to the exposure of Port Los Angeles and its being exposed to the full force of the ocean swells; second, the testimony given by Captain Polhamus in reference to the direction of the swell—the true ocean swell. The question was asked by the chairman, which the record will show, if I made a correct copy of it: "What is the direction of the swell off Point Concepcion—the open ocean swell?" and the answer was "Trending down the coast." I also wish the Board to have the advantage of the large experience of this witness in various parts of the world and in various harbors in reference to the point that has been made of the "whipping in" on 45° angles of waves around the breakwater.

The next point that we wish to controvert by this witness is the statements that have been made and the testimony that has been brought forward here in reference to the alongshore currents; four quite material points. It will require an illustration and the testimony and experience of this witness, in order to controvert those four points or rebut them.

Mr. CORTHELL. How many years' experience, Captain, have you had on the ocean?

Mr. SALMOND. I have had twenty-seven years' sea experience.

Mr. CORTHELL. How many years on this coast?

Mr. SALMOND. Fifteen years.

Mr. CORTHELL. How many years have you been in command of steamships coasting along this part, and between what points?

Mr. SALMOND. Ten years' experience, as master on this coast, between Cape Flattery and San Francisco principally and right down the coast as far as Panama.

Mr. CORTHELL. In reference to the Pacific Ocean navigation, how many years have you been an officer on Pacific Ocean vessels and where?

Mr. SALMOND. I spent five years as an officer on board of the mail steamships between San Francisco and China.

Mr. CORTHELL. I would like to ask in regard to your long experience, that you say is about twenty-seven years. You were, I believe, formerly a British seaman. Have you received any appointment or certificate of competency from any British navigation body or board, and if so, what?

Mr. SALMOND. I hold an ex-master's certificate of competency, granted by the British board of trade as master mariner.

Mr. CORTHELL. Please state to the Board what ship you now command, what its business is, and by whom owned, and the points you make in your voyages.

Mr. SALMOND. I am now in charge of the collier *Wellington*, trading between San Francisco and the owners' mines in British Columbia. Messrs. R. Dunsinclair & Sons are the owners of the steamer.

Mr. CORTHELL. What is the registered tonnage of the vessel?

Mr. SALMOND. The registered tonnage of the steamship *Wellington* is 1,267.

Mr. CORTHELL. About what draft?

Mr. SALMOND. Twenty-one feet mean loaded.

Mr. CORTHELL. I would like to ask when it was that you first came down to Port Los Angeles Wharf, where you now run, and for what purpose?

Mr. SALMOND. The Southern Pacific Company being desirous of chartering the *Wellington* to run coal to Port Los Angeles, the owners, Messrs. R. Dunsinclair & Sons, having heard that it was a dangerous harbor, ordered me to proceed to Port Los Angeles and there land several cargoes, and at the same time examine, as far as I possibly could, whether it was a safe and proper place to send their ships or a safe place to send large consignments of coal. In March, 1894, I made four consecutive voyages to Port Los Angeles Wharf, and the result of my experience there, having experienced fine weather and also what was considered a strong gale of wind, I reported to my employers that I considered Port Los Angeles Wharf a safe place to send their steamers to. On that report they continued to send large consignments

of coal to the wharf, and since then they have never lost any trips. Again, in January, 1895, conflicting accounts came of the nature of the wharf as a harbor. Again I was dispatched to the wharf. Fortunately I was only required to make one voyage, for on that voyage in January, I think about the 13th, I experienced a very heavy gale of wind. I landed alongside of the wharf during a gale of wind. It must be in the minds of everyone present located here, because of the large number of washouts and cold, stormy weather. I landed alongside of the wharf, and for the first time I was unable to work the cargo, not from the nature of the sea that was there but from the strength of the wind, the wind being so strong that it was impossible to manipulate the cranes. The wind actually blew the coal out of the tubs, endangering the men below. We stopped work for about a day and a half, owing to the strength of the wind. Whilst alongside of the wharf during this wind, as every sailor knows, the sea must necessarily rise. Now, when alongside of this wharf with this strong wind, the sea did not rise as it would in the open. It was comparatively smooth. I also observed that along toward Santa Monica the sea gradually increased in size. I took a buggy and drove along the shore and went as far as Santa Monica. I found that looking on toward Redondo the sea was still larger; that it gradually increased. This to me appeared a peculiar phenomena, because standing on the wharf from the northern edge of Catalina Island to Point Dume, with the wind at sou'west by south, there is comparatively no protection in sight; therefore I could not make out why this smoothness should exist.

Mr. MORISON. How high were the waves at that time?

Mr. SALMOND. The waves alongside of the wharf were not more than 5 feet high.

Mr. MORISON. Which way did the wind blow?

Mr. SALMOND. The wind blew from southwest to southwest by south.

Mr. MORISON. How strong a wind was it?

Mr. SALMOND. About force 9; from 9 to 10. My recollection is 10. For my own pleasure I determined, if I possibly could, to find out the reason why the sea should be less in Santa Monica Bay than it was farther down the coast, and I made it a study, little deeming that I should ever be required to express it to anyone, and if you will follow me I think I can—

Mr. CORTHELL. The witness has a chart.

Mr. SALMOND. I have a chart of my own [chart handed to Board]. Now, gentlemen, regarding the direction of the ocean sea or swell. The direction of the ocean sea swell is west a half north true abreast of Point Concepcion, which direction has 15° of easterly variation, west by south; that is, the line of variance is west by south and east by north. We know that this swell—that is, the westerly swell as we generally term it—is the same in the Atlantic as it is in the Pacific. It varies at times. At times it is scarcely perceptible, and at other times it is quite high. Now, when a breeze springs up and this swell is in existence, the sea rises on that swell and must necessarily be higher than if there was no swell at all. Now, this line of variance, we will take it west by south or east by north, and I wish you to draw a line passing through Cape Concepcion and extend it to the coast line at the point called Rincon Point.

Mr. MORGAN. How many points south is west by south?

Mr. SALMOND. Eleven degrees.

Mr. MORGAN. Eleven and a half or just 11 degrees?

Mr. SALMOND. Eleven degrees. We then draw a parallel line touching the northern edge of Santa Cruz Island, cutting the coast about Point Dume. We draw another parallel on this line, touching the south edge of Santa Rosa Island, and extend it to the seacoast, which it cuts at a point about 3 miles north of Point Vincente. Again, a fourth parallel, which touches the north edge of Catalina Island, and extend it to the coast line, which it cuts at a point about 3 miles south of San Juan, or San Juan-by-the-Sea. The fifth parallel, cutting the south edge of Santa Catalina, and extended to the coast line at a point about 14 miles below San Juan-by-the-Sea.

Mr. MORISON. You are stating your theory?

Mr. SALMOND. Yes, sir. Now, we will take the first line here, and we find that evidence given by Captain Alexander I can corroborate. Santa Barbara is a pretty smooth place. It lies within the protected area of this line. You take then between the parallels Nos. 1 and 2, and we have Santa Barbara Channel, which is between these parallels, about 20 miles wide. Between these parallels we have no barrier whatever, but the westerly swell rolls right in and strikes the coast line between Point Rincon and Point Dume. Between Nos. 2 and 3 we find a chain of islands designated on the map as Wilson Island, San Miguel Island, Santa Rosa Island, Santa Cruz Island, and Anacapa Island. These islands form a chain 58 miles long and 12 miles wide, forming an obstruction and a natural barrier to the westerly swell which takes in a portion of this coast between Point Dume and a point 3 miles north of Point Vincente, which is the Santa Monica Bay. Again, we take between No. 3 and No. 4 parallels, a distance of about 20 miles, and we find no barrier whatever. This westerly swell or west by south swell flows right in unobstructed and strikes the

coast line between a point 3 miles north of Point Vincente and 3 miles south of San Juan-by-the-Sea.

Again, between Nos. 4 and 5 we have Catalina Island. This covers a portion of the coast between San Juan-by-the-Sea and a point 14 miles south of San Juan-by-the-Sea. Now, the conclusion from my argument—the question is raised in the evidence that has been before you that the sea at Santa Monica is higher than the sea at San Pedro. Now, should this swell not exist and a gale spring up from the southwest, San Pedro and Santa Monica would be in the same condition, but should this west by south swell exist, then Santa Monica being within the protected area formed by this barrier, would certainly have only the swell raised by the sea, whereas San Pedro would have the combined effect of the westerly swell as well as the sea raised by the waves. Now, for example, we need not go any further back than yesterday. Yesterday there was a breeze of wind in the morning, and by observation we found that at Santa Monica there was a swell which had come in by the wind; whereas, at San Pedro, there were two swells. There was this swell that I contend is always rolling in, as well as the swell that was raised by the wind, making a square, choppy sea. That, gentlemen, is the conclusion I have arrived at, why during a strong gale of wind in Santa Monica Bay the sea did not raise, because it is only the sea raised by the wind, or I am not a sailor.

MR. CORTHELL. What has been your experience in navigating this coast in confirmation of that theory?

MR. SALMOND. I made several voyages down to San Diego. Coming up from San Diego on one occasion I was caught in a fog. I determined in accordance with sailing directions of the coast that I could obtain a better result by coming through Santa Barbara Channel. You see we catch from a quarter to 3 miles tide in our favor. I was caught in the fog, and on this coast the fogs are very prevalent, and it behooves a shipmaster to study everything that will possibly assist him in the navigation of his ship. Currents he can't gauge at all, but he can gauge what is absolutely in sight, and the only thing in sight in fog is the usual swell. Therefore it behooves us to notice it. In coming up here, as soon as I got under the lee of Catalina Island, the swell disappeared, and as soon as we opened out we had the old sea swell again, the westerly swell. Again, as I passed up the weather cleared up, and I had the same experience within this protected area opposite Santa Monica Bay. We had no swell or but little.

MR. CORTHELL. By "this protected area," what do you mean?

MR. SALMOND. The protected area behind the chain of Santa Barbara Islands, between those two parallels, No. 2 and No. 3. When we come to speak of the parallel between Nos. 2 and 3, the evidence of Captain Pillsbury is that he usually had a swell as he came along past the Santa Barbara Channel, but when he got to Point Dume it smoothed up. When he got to Point Dume he passed in through this protected area, which I can corroborate by personal experience. I have passed in with a heavy gale and a big swell, with a high sea running right up the channel, and as soon as I got within this protected area it smoothed down. In explanation, I wish to say that the sea at Santa Monica tapered off, as it were. It became smoother from Santa Monica toward Point Dume. Now, my opinion is, the swell rolling in here when it gets clear of the island does not immediately fall back, but flattens out, and therefore tapers and becomes smoother in toward the bay.

MR. CORTHELL. How did you ascertain the bearing of this true ocean swell, and did you at any time investigate it for the purpose of the Government?

MR. SALMOND. During my service on the Pacific between San Francisco and China I observed for the Meteorological Bureau at Washington, and our daily observations, of course, are of the sea swell. The term "swell" is applied to the undulations on the ocean when it is smooth and there is no wind. Sometimes when the wind has raised the sea, we give it "with the sea," such as "moderate sea running with a westerly swell," because at times the swell is but slight—the strength of the wind covers it up, and for the time being it is lost to sight. The term "sea," of course, is always applied to that which is raised by the force of the wind.

THE CHAIRMAN. You draw a distinction between the true ocean swell and the surface sea?

MR. SALMOND. Yes, sir.

MR. CORTHELL. If you are through with that matter, I would like to ask you in reference to the shore current, what you have found by your experience to be the set of current or the prevailing set of the currents along this shore that you have been navigating, and whether you have discovered that by your log and your navigation generally, and under what instructions you have had to do with this current. Just give the general features.

MR. SALMOND. In coasting along this channel, passing in fine weather, we take our position by point bearing; that is to say, we take our distance off from the light-house of Point Firmin and set our logs, and when we get down to Hueneme we take time and distance by the log. Now, the distance we can measure by the chart and

the distance run by our logs gives the distance that the ship has passed through the water. Now, if we have an adverse current the log will show more than the actual distance, and if we have a fair current it will show less. So, then, we measure the distance between the actual distance, and the set of the current is the difference; that is if the logs are correct.

Mr. MOORE. This is in rebuttal of what?

Mr. CORTHELL. The testimony that has been given that the current goes to the south. He has not got to that point. I will ask you if you found that the set of the current or the prevailing current is—

Mr. SALMOND. I found the set of the current to be north and west.

Mr. MORISON. How far from the shore?

Mr. SALMOND. About 5 or 10 miles.

Mr. MORISON. You mean between 5 and 10 miles out the current sets to the north?

Mr. SALMOND. Yes, sir.

Mr. BURR. Have you made any observations of the current closer inshore?

Mr. SALMOND. No, sir; only passing the salient points about 5 miles out.

Mr. CORTHELL. Are there or not any sailing directions in regard to this matter?

Mr. SALMOND. Yes, sir.

Mr. CORTHELL. What are they?

Mr. SALMOND. The directions are that we usually experience a current from 1 to 3 knots in our favor.

Mr. CORTHELL. Going in which direction?

Mr. SALMOND. North and west.

The CHAIRMAN. And you keep closer inshore?

Mr. SALMOND. Yes, sir. There is one direction which says that by keeping closer inshore in the Santa Barbara Channel you will take advantage of the westerly current.

Mr. MORISON. Where are those directions—in what volume?

Mr. SALMOND. In the Coast Directory.

Mr. MORISON. The Coast Pilot?

Mr. SALMOND. Yes, sir; the Coast Pilot.

Mr. CORTHELL. There is only one more question, and that is to give the Board, for their information, from your experience, your views in regard to the waves running around breakwaters or islands. It has been, perhaps, those rather than breakwaters you have usually had to do with?

Mr. SALMOND. My opinion, and also experience, if there is any obstruction in the water, either waves or tide, that it rather sets off than whips in. If you see an island in the middle of a stream, or put in a pile and watch the edges, they do not whip in. They whip out. You can see it at any time. Also, if you watch the wave, it falls in, in a measure, but it does not whip in. It rather whips out.

Mr. CORTHELL. That is all the direct questions.

Mr. MOORE. Captain, will you read what is on that map, on the arrow? (Witness goes to map.)

Mr. SALMOND (reading). "Direction of heavy ocean swell, north 42° 24' east, magnetic."

Mr. MOORE. Then you would say that whoever put that there was in error?

Mr. SALMOND. Certainly; that is not the ocean swell. That is the same swell that I saw the evidence given here of being 10 feet high in a small boat 35 feet long.

Mr. MORGAN. This protected area, as I understand you, has reference to protection from the ocean swell?

Mr. SALMOND. The true ocean swell.

Mr. MORGAN. How does that protection affect the winds of a storm—does it afford protection?

Mr. SALMOND. Do you mean to the leeward of it?

Mr. MORGAN. I mean to the distance that it affects the swell itself. It does not affect the winds?

Mr. SALMOND. It does not affect the winds.

Mr. MORGAN. What sort of a sea would a storm get up, for instance, between Catalina Island and Santa Monica or San Pedro?

Mr. SALMOND. With a swell?

Mr. MORGAN. Yes, sir; assuming that the swell is broken.

Mr. SALMOND. That there is no swell?

Mr. MORGAN. That is assuming the swell to be broken by the island that you speak of. You speak of a sea as an expression having reference to the effect of wind. Now, what sort of a sea would rise in a gale between Catalina and San Pedro, a distance from the end of the island of 26 miles, and the nearest distance 17, as I have measured it?

Mr. SALMOND. A gale of wind would raise a sea between Catalina Island and San Pedro without any swell running, exactly the same as it would in Santa Monica, or nearly the same from the southwest—not southeast, southwest—and the sea or waves

would rise 4 or 5 feet, or 6 feet, perhaps, at the very outside. A gale of wind would raise a sea the same as we experienced up north in a landlocked bay, or perhaps a little worse, as in the Sound and the Gulf of Georgia.

Mr. MORGAN. How would it affect the operation or movement of a vessel in entering a harbor, a sea of that kind?

Mr. SALMOND. Well, without any protection we run for breakwaters if it be a harbor of refuge, and it is not a harbor of refuge unless it can be taken at any time. Then it may be termed a harbor of refuge. We have harbors of refuge on the coast of England, and when we run for them we want them badly, and we have to get them, and we make them. Of course accidents happen when a man makes a mistake and does not get there, but a harbor of refuge is supposed to be a harbor that a vessel will make under any conditions whatever. He is storm pressed and he has to get there.

Mr. MORGAN. In your practice on the coast here you have had experience with heavy fogs undoubtedly?

Mr. SALMOND. Yes, sir.

Mr. MORGAN. And in those fogs there are sometimes strong winds and gales; is there such a thing as that?

Mr. SALMOND. When we have fogs, sir, we have seldom any wind.

Mr. MORGAN. You have wind?

Mr. SALMOND. Very seldom.

Mr. MORGAN. You have some?

Mr. SALMOND. Very little.

Mr. MORGAN. How do you operate a vessel or manage a vessel during a fog; do you rely strictly upon your reckoning, or do you keep off the coast a little?

Mr. SALMOND. On this coast service, especially this Pacific Coast service, we experience a large amount of fog, but we are compelled to run; that is to say, if we waited until the fog cleared up on this coast we might wait forever. I myself made four consecutive voyages from San Francisco to Victoria either way and saw nothing whatever save the sound of whistles on the shore, not even the sun, and we are compelled to navigate on this coast—and it is peculiar in that respect—in a large amount of fog. Navigators have often testified that they have to navigate their ships anyway. Of course there are a large number of accidents on this coast, and we have to rely entirely upon our personal observations of wind and sea. We have no chance of observation, and the only other true guidance we have is that of the whistles on the shore.

Mr. MORGAN. I have gone outside of the rebuttal a little.

The CHAIRMAN. Members of the Board can ask any question they wish.

Mr. MORGAN. The question of fog has not been discussed much, and I would be very glad to hear about it.

Mr. SALMOND. I have never heard in my experience on the coast in a number of years and never knew any part of this coast that could pride itself in saying it was better than another in respect to fogs. They may say so, but I have never found it so.

Mr. MORGAN. How was this about the Straits of Fuca?

Mr. SALMOND. The Straits of Juan de Fuca are very bad.

Mr. MORGAN. Do you say they are better than any other parts of the coast?

Mr. SALMOND. I have heard different parties say, "We have no fog here." Well, when it is not there it is somewhere else.

Mr. CORTHELL. You have been tied up at the wharf at Port Los Angeles?

Mr. SALMOND. Yes, sir.

Mr. CORTHELL. Is the direction of the wharf head on to the swell that reaches the wharf?

Mr. SALMOND. It is head on to the swell that reaches the wharf there. It lays at a very fine angle. It just catches the swell. Now, regarding this swell, gentlemen, for the information of the Board, from my experience on the coast here, I saw from a part of the evidence that with the wind southeast, and even when there was no wind at all, the sea rolled in from the southwest. I think Captain Dornfeld gave this evidence. Now, there is a peculiar feature on this coast regarding the winds, which I attribute to the laws of nature that govern the trade winds. You know full well that the trade winds, or the northeast trade wind is strongest when the sun is south of the line, and southeast trades when the sun is north of the line. Now, on this coast, especially during the winter time, from Cape Flattery right down the Coast Range—and we have experienced it at Los Angeles by simply going up Mount Lowe, and it is very cold up there—that the southwest winds and a southerly wind blows up toward the coast line, but the cold air on the mountains presses toward this warm belt, and we find the wind inshore hauls around to the southeast; that is, when you are going inshore you find it from the southeast, even as far as east-northeast. A ship offshore would have the wind southwest, whereas a ship close up inshore would have the wind east-northeast. This we have repeatedly found on this coast. Now, the evidence which you have received that the wind started at the east and southeast and then went around is quite correct. At first this cold air starts

to rush out toward the warm belt, but the wind, strengthening from the southwest, breaks this down, and it winds up by going to the southwest and blowing with all its strength. Sometimes the wind drops down and it is not of sufficient strength, and it winds up with a southwest swell only.

Mr. CORTHELL. You have testified here in reference to the breaking through of the true ocean swell from the west?

Mr. SALMOND. Yes, sir.

Mr. CORTHELL. You state that the swell reaching Port Los Angeles Wharf is head on to the wharf, and the wharf is properly located. How do you account for the sea or the swell, or whatever you may call it, changing its direction from the true westerly direction to the direction of the wharf? That is what I would like to bring out, and which you did not bring out in the direct testimony, which led Mr. Moore to ask that question. I would like to have it understood.

Mr. SALMOND. We find here in this protected area between Nos. 2 and 3 the westerly swell is checked between No. 3 and No. 4, and we have the full sweep of the westerly swells. When this swell has ceased beyond this barrier the impetus of this swell is not altered. It will continue. The impetus of the swell seldom turns in any direction to the side, but it will flatten down. My opinion is that it flattens in toward Santa Monica. Another peculiar idea of all waves is their desire to hit a beach at right angles or parallel. If you walk along the beach you will notice that the waves, if they come in angling, strike the beach squarely. This, of course, anyone can see for themselves.

The CHAIRMAN. As I understand it, the way you get at your currents in coming up the coast is the difference between the log and the bearings you take as you run along the coast?

Mr. SALMOND. Yes, sir.

The CHAIRMAN. In order to see the apparent distance you take the time that passes and compare them and that will show the true distance?

Mr. SALMOND. The actual distance; yes, sir.

Mr. MOORE. Do I understand you to say that the swells in the Santa Monica Bay as they reach the coast run west?

Mr. SALMOND. The swell in Santa Monica Bay is not the ocean current or the ocean swell.

Mr. MOORE. How do the ocean swells reach the shore of Santa Monica Bay at Port Los Angeles; do they reach there from the west, or not?

Mr. SALMOND. They do not flow in from that direction. They do not reach there, as I explained before.

Mr. MOORE. From what direction do they actually reach the coast?

Mr. SALMOND. They do not reach there at all. They are not there. You see that in the protected area they cease and the momentum is stopped by this barrier.

Mr. MOORE. Such swells as do get in there come from what direction?

Mr. SALMOND. The direction the wind sends them in. The swell reaching Santa Monica Bay is the swell produced by the direction of the wind.

Mr. MOORE. Is that from the west or the southwest; which direction?

Mr. SALMOND. The way in which the wind blows.

Mr. MOORE. Any direction, then?

Mr. SALMOND. Any direction.

Mr. MOORE. A southeast wind?

Mr. SALMOND. No; fortunately for Santa Monica Bay, if you take the direction of the southeast wind it has got San Pedro Hill to check the wind, and therefore if you check the wind you don't raise the sea.

The CHAIRMAN. The hearing will stand adjourned until to-morrow morning at 10 o'clock.

SEVENTH DAY.

DECEMBER 30, 1896.

The hearing was resumed at 10 a. m., all members of the Board being present.

The CHAIRMAN. Mr. Corthell, you have the floor.

Mr. CORTHELL. Mr. Chairman and gentlemen, in this rebuttal of testimony given by the other side of this question, I shall endeavor to confine myself to controverting statements that have been made and not bring any new matter into the hearing.

First, in regard to the testimony of Mr. Moore. I will refer throughout my remarks to the pages of the stenographic notes. On page 364 he quotes from Colonel Mendell as having in 1881 given the opinion "that a breakwater in the bay of San Pedro which would give security to vessels under its lee at all times would be a very desirable construction." I wish to add that in 1882 Colonel Mendell gave a favorable opinion in regard to Santa Monica, as follows: "If the access of these waves west and southwest, as here described, were kept off, the bay would become a harbor which might have any desired capacity. As an engineering proposition, a project of this kind appears to be entirely feasible, and a breakwater judiciously located would secure the result."

Perhaps it might be well to give more of this, in order to cover the whole question as stated by him:

"An anchorage ground over which for a width of about seven-eighths of a mile the water would be between 3 and 8 fathoms could be protected by a breakwater in 8 fathoms of water. A greater width would result by the location of the breakwater in deeper water. The length of the structure would be determined by the extent of the area which it is desired to protect. While the project is entirely feasible it must necessarily be costly."

Then he adds (this is quoted from Congressional Record, page 11, in the bound volume in your hands): "Santa Monica at present has no commerce."

Mr. MOORE. Will you read a couple of sentences further?

Mr. CORTHELL. I haven't anything further. It is from Senator Frye's speech.

Mr. MOORE. I thought you would read a little further from Colonel Mendell.

Mr. CORTHELL. That is all I have. It is a quotation from his speech. In this connection I would like to read an extract from Captain Taylor's communication which is in evidence here:

"A creek makes into the land at Wilmington and San Pedro, affording a shelter to small vessels, and expensive improvements have been carried on for several years by the army engineers, which have slightly benefited it; but at the best that can be hoped it can never have the accommodation of a great harbor. A breakwater to include sufficient area of shelter could be built, but it would include some shoals and rocks inside of it, and would also receive whatever discharge of sediment there would be from the creek. This creek was used in the beginning for schooners and small craft which was sufficient for the trade of the then unsettled country. The circumstances of its location favorable for such craft are unfavorable for the formation of a great harbor such as the commerce of southern California now demands."

Mr. Moore referred to a statement on page 19 of my remarks of the 21st, and as Mr. Moore has used this to base his opinion on, and stated that it was the opinion of the army engineers that had examined the question, I will give it again:

"The San Pedro Hill, 1,493 feet high, which forms the west side of the bay, furnishes a more protected shelter from wind and sea than could be afforded by any artificial structure in Santa Monica Bay."

I need not refer to the comments which were made on that sentence. I asked in my remarks as to whether Santa Monica, or Port Los Angeles, with a hill or mountain 2,000 feet high, is not equally protected from the same wind and the same sea; but Mr. Moore has gone still further than the Board did, and has adopted this sentence of the Board as the general opinion of that Board, which I do not think they would be willing to have attributed to them. He says: "It is a verdict which substantially expresses the opinion of both Boards and of every engineer officer who has expressed himself up to the present date." On page 323 of the stenographic notes, Mr. Moore, in describing the bay of Santa Monica, gives to it the same protection that the Board of 1892 gave to San Pedro Bay, and states that the high hills on the north and east shores of the bay shelter this point—that is, the northeast angle of the bay of Santa Monica—from the winds coming from this direction [showing]. Mr. Moore has assumed and used the word not directly describing this bay of Santa Monica, but in a quotation from Mr. Stevenson, or from some other source, that Santa Monica Bay is a bight. I am not familiar enough with nautical terms to know whether this bay is a bight. I should apply that term, from my limited knowledge of the subject, to San Pedro Bay. And that recalls to my mind the very intelligent and complete description of Brito Harbor, at the Pacific terminus of the proposed Nicaragua Canal, made by Professor Mitchell, formerly of the Coast Survey. He calls it a bight, and says that it is called a harbor by courtesy. If anyone will examine the physical conditions at these two points, they will find that they are quite similar.

On page 323, Mr. Moore describes Santa Monica Bay as a funnel-shaped form. I do not think the Board will agree that this is a funnel-shaped form. The Bay of Fundy is called funnel shaped, and so is the Wick Bay. We call a bay funnel shaped up which the tides race and rise to a very considerable height, but Santa Monica Bay is not funnel shaped, by any means. But, having assumed that it is a funnel-shaped bay, Mr. Moore bases certain physical facts upon its shape as a funnel, and states that it has a tendency to concentrate or pile up the waves at this point, and that this is probably the cause of the greater height of the tidal wave in Santa Monica Bay, as compared with San Pedro Bay, and makes the somewhat remarkable statement, which I have endeavored, patiently but unsuccessfully, from official records to verify, that "at San Pedro the mean range of the spring tides is 4.7 feet, while at Santa Monica it is 8 feet, or 70 per cent higher."

In the tide tables for the Pacific Coast of the United States, made by the United States Coast and Geodetic Survey, I believe by W. W. Duffield, Superintendent, for 1897, I can not by using the ratio of tidal range find more than four-tenths of a foot difference at the time of the greatest difference which is noted in here for every day

in the year. The range of tide on page 365 of the tide tables gives for San Pedro the mean range of tide as 4.1 feet and for Santa Monica 4.3 feet, and for spring tides 5.5 feet for San Pedro and 5.7 feet for Santa Monica, and for neap tides 2.5 feet for San Pedro and 2.6 feet for Santa Monica. Low tide is about the same in both locations; that is, about a tenth of a foot greater than at San Diego Bay, from which San Pedro and Santa Monica tides are figured. In other words, the difference in tide is about two-tenths of a foot.

Further than that, in a funnel-shaped entrance like the Bay of Fundy, or any other large funnel-shaped bay like the Bristol Channel, the tide is retarded at the time it is piling up higher and higher, and the cotidal curve shows it very plainly, but at San Pedro and Santa Monica the tidal difference is only about two minutes. In other words, the tides and the time of the tides are the same at both places. Last Sunday I was at Port Los Angeles, and simultaneous tide readings were taken at both Port Los Angeles and San Pedro. I took it at Port Los Angeles at 12 o'clock and had it taken at the same time at San Pedro at the wharf of the Southern Pacific Company, which is where the tide gauge is located. The tide-gauge referred to is the one used by pilots and navigators at that point. This showed that the tide which was coming in was 2.95 at Port Los Angeles Wharf, and 16.6 at San Pedro Wharf in the inner harbor. The gauge at Port Los Angeles reads above mean low, or low water of the Coast Survey, which on the San Pedro gauge is 14 feet; the object, I understand, of this reading at San Pedro being to give tugboat men and pilots from the reading the depth of water on the bar. This shows that the tide at Port Los Angeles was thirty-five hundredths of a foot, or about 4 inches, higher than at San Pedro; but the latter gauge is in the Wilmington inner harbor and the Port Los Angeles gauge in the open harbor. Had the San Pedro gauge been similarly situated there would no doubt have been less difference than there was; or had the two gauges been read on the top of the tide, or some little time after the tide was in, located as they are, the two-tenths difference of the Coast Survey tide tables would no doubt have been confirmed, all of which shows that the funnel shape of this bay, if it does exist, has no effect upon the tides.

In reference to the general objection that has been urged by Mr. Moore and by Mr. Hawgood as to the danger of embayments in a wide bay like Santa Monica, I will say that I believe it is entirely imaginary. For instance, I may ask what danger could there possibly be with two ample entrances to the protected harbor—perhaps a mile on one side, say between the 9 and 4 fathom curve, and on the other nearly three-quarters of a mile? Would these conditions not compare favorably with the form of harbor proposed by the Board of 1892, or by Mr. Moore himself, with one entrance at San Pedro? Under southeast winds, when vessels would run for shelter as to a harbor of refuge, would they not prefer, if there were a breakwater at each place, to run in behind a breakwater at Santa Monica? And under a heavy southwest wind, it seems to me they could make the shelter of that harbor at Santa Monica better than at San Pedro.

Now, in reference to sand movement. (See bottom of page 330.) Mr. Moore makes the statement that I admitted, in response to a question from him, that the statement in regard to providing against the sand movement by the Board of 1891 was only a matter of inference. I wish to state that, due to the abruptness with which the interrogations on this subject ceased at the time, the matter was not fully explained. I now give what seems to me is proof that the Board of 1891 did have this sand movement in mind. On page 104 of Executive Document No. 41, report of the Board of 1892, Professor Davidson states how he and Gen. B. S. Alexander frequently discussed the matter of the breakwater and "with the charts of the Coast Survey before us, we have drawn rough lines of the suggested breakwater to cover the exigencies of vessels entering the harbor from the west or around the exterior eastern extremity of the breakwater, and to give free movement to the inshore eddy current carrying its material to the westward." And he adds in a bracket that he, General Alexander, utilized this movement of material in planning the present jetty. By the present jetty, he means the plan that was before the Board of 1891. They hadn't formulated any plan at that time, I should judge from his remarks, and the only one, as far as I know, that was before that Board (that is, the Board of 1891) was one with two openings and for two purposes, accessible in all winds, and to prevent the deposit of sediment; which plan evidently the Board of 1891 copied from General Alexander. Now, that is the inference; but I am taking the context of this matter, the statement of Professor Davidson, and the facts as they were before that Board.

Now, that this is a correct account of the matter and, I think, a correct inference, is evident from the following remark made by the Board of 1892, on page 15 of its report, as follows:

"As above remarked, the project of the Board of 1890 (what we call 1891) for the formation of a harbor at San Pedro, proposes the construction of two breakwaters covering an area east of Point Firmin from the southeast and southwest seas. An opening of 1,500 feet is left between them to afford an entrance to the harbor from the westward and provide for the circulation of the littoral currents."

Either from the communication already quoted from Professor Davidson or from information in the United States Engineer's Office at San Francisco, this Board of 1892 were evidently informed as to the reasons for these two openings or they would not have stated them.

It is noticeable that the report of the Board of 1891 was very brief, and it no doubt assumed, without argument or statement of the conditions, what evidently was a well-known condition and requirement, viz, the nautical necessity of two openings and the advisability of providing for the movements of the sand-bearing littoral currents.

Now, in reference to the sea slope, which has been discussed so fully. I hope the Board will bear with me while I still discuss it further. It has been referred to as a theory; in my opinion, it is a fact. From experience all over the world and everywhere among practical nautical men and maritime engineers who have had to build works in deep water, the deep water in front of the breakwater produces greater and more destructive waves than are found in the shallow water. I will not take the time of the Board to quote on this subject from any authorities, but will refer to Mr. Harcourt's book, pages 22, 25, and 26, particularly the note at the bottom of page 25. I do desire to quote briefly one passage from Captain Lecky, who wrote a book that is well known all over the world, and is considered, I believe, as authority on many points by practical navigators. The book is entitled *Wrinkles in Practical Navigation*, and was published in 1891; that is, the edition which I have was revised and republished in 1891. Before I quote it, I wish to describe the condition that he alludes to.

On the Malabar coast a very peculiar formation exists in the ocean bottom south of Bombay on the coast of India. Evidently there have been at some time great upheavals and the formation of very peculiar slopes. First, there is a very deep sea bottom, and then at points a very steep submarine shore, and then an easy slope toward the land varying from 600 to 1,000 fathoms in the deepest parts, and then suddenly up to about 100 fathoms, 25 miles from shore; then an easy, gentle slope to the shore line, there being about 100 fathoms 25 miles from shore and about 20 fathoms 10 miles off from shore.

The other comparative points which he alludes to are at Lisbon, at the mouth of the river Tagus, and the conditions there I will briefly compare with San Pedro. Three miles off the mouth of the Tagus River the water is 50 fathoms deep; 10 miles off it is 300 fathoms. Please bear these figures in mind, in order that the remarks of the writer may be applied. At San Pedro generally (this is a general statement, which can be verified from the chart) 2 miles from shore it is 50 fathoms deep, and 4 miles from shore it is 300 fathoms deep; that is, it is a deeper shore off San Pedro than at the Tagus. These are the expressions; the name has escaped the writer's memory, but there is a place on the Malabar coast where the water for miles seaward shoals so regularly and slowly over muddy bottoms that the force of the southwest seas during the southwest monsoon is quite spent as they come in near the land, and it is common for small craft to run in on a lee shore and anchor without fear in 4 fathoms; for conditions of the opposite character, where it shoals abruptly from a depth of 700 fathoms, exist only a few miles to the westward. During the winter the deep-water undulations come rolling in in an unredacted form and break with terrific violence. It would be very difficult to find a place in India or Portugal that compares exactly with a place in southern California. I wish to be absolutely fair in this description, and the figures that I have given show that the conditions at San Pedro are worse in respect to the point he is illustrating than they are at the Tagus. At Santa Monica the conditions are somewhat worse than they are at the Malabar coast, but generally the point which the writer intended to bring out is properly used.

Coming now to our location again, referring to the subject of a commercial harbor described by Mr. Moore on pages 368 and 369, which I need not read, it may pertinently be asked if these requirements can not be just as well arranged in Port Los Angeles Harbor as at Point Firmin; and in respect to the inner harbor which the advocates of San Pedro persist on discussing (and granting for a moment that it comes within the limit of the law, which I think it does not at all), Mr. Moore, on page 371, says that there is no reason why 26 feet or even 30 feet can not be obtained in place of the 14 feet that now exist. Evidently this remark was made without careful investigation or without making any estimates. These the Board can make for themselves. I have not examined into this matter carefully enough to give figures as to any estimate. I simply would suggest that the Board do that for themselves. If it will require, according to Colonel Benyaurd's estimate, about \$400,000 to deepen the channel, with no jetties to build and no excavation or little of it beyond the end of the present jetties, from 14 feet to 18 feet, what will it cost to deepen it to 30 feet? And in addition what will it cost to build nearly a mile and a third of heavy jetties, in depths running from 16 feet to 5 fathoms, exposed to the southeast gales even after the breakwater is built? I can not figure out a cost of much less than \$3,000,000.

Right here in regard to the kind of material that may have to be moved to make this very deep channel—there has been testimony offered here that it was very easily moved by almost any kind of a dredge, but Colonel Benyaurd, who ought to be better authority because the work was under his charge for many years, states that it will require to deepen opposite Deadmans Island from 14 to 18 feet the removal of 37,000 cubic yards of hard material, which he estimates will cost \$2.50 a cubic yard.

I have no idea that the Board will take the opinion of Mr. Hawgood on the question of what is deep enough water for ships. I have had considerable to do in my own experience with harbors, and have had professionally to study and write upon many matters connected with the harbors of the present day. I am keeping data up to date, and for two decades have written the article on ship canals for Johnson's Encyclopedia, taking in the Suez Canal, the proposed Panama Canal, the Nicaragua Canal, and several others of the prominent canals of the world. This has brought me into correspondence with the engineers that have had to do with them, and from them I get information which I think is reliable. I will refer the Board to Johnson's New Encyclopedia, published in 1891, for data in regard to depths of channels.

In reference to harbors, Mr. Hawgood intimates—in fact, I believe he says—that 25 feet is sufficient, and refers to Portland, Oreg., which is a long ways up the Columbia River, and then several miles up the smaller Willamette River. It would hardly be expected that a harbor that would do for Portland would do for a great harbor on this seacoast. I will give briefly some data to show what the present tendency is in reference to harbors which meet the necessities of the commerce of the world in respect to deep-draft vessels. I believe that at Liverpool (though I will not state definitely) it is intended to deepen that bar so that vessels that go out of New York without delay can go into Liverpool without delay. They have already deepened it, and the work is being continued by a very powerful dredge that is constantly at work there. As has been stated here by the Board in its discussion, there are now 30 feet at New York, and on page 45 of the law under which this Board is acting—the river and harbor act—you will find an order for an examination for 35 feet out of New York Harbor. At Baltimore a project is now under way, which you will find on page 7 of the river and harbor act, to obtain a depth of 30 feet. Even at Annapolis the project for examination is now 28 feet. Boston, which now has 27 feet, and which the commercial men of Boston consider and prove is entirely inadequate for the business of Boston, sent a committee to Washington last winter to urge upon Congress an appropriation for 30 feet. There is provided in this same river and harbor act, which you will find on page 43, a project or an order for examination to obtain a channel 30 feet deep and 1,200 feet wide.

Mr. BURE. These depths are at low water, I suppose?

Mr. CORTHELL. Yes, sir; all of them. I may not be accurately informed, but I think there has been obtained a 30-foot channel out of the Columbia River by the jetties built there. At Galveston the project calls for 30 feet, and although the jetties have not obtained it, yet there is a dredge at work there, and that will be the ultimate depth; nothing less. I am acquainted with the jetties at the mouth of the Mississippi, where Captain Eads obtained a channel 30 feet deep through the jetties. Unfortunately, the depth through the pass 12 miles long leading to the jetties was, by the requirements, only for a navigable depth of 26 feet, which nearly twenty years ago was considered a deep channel. It is a fact that New Orleans and the immense business that is now tending there from St. Louis and all of the Mississippi Valley is hampered by the want of deeper water, and is discriminated against in its movement of traffic by the deep water at Baltimore, at New York, and at other ports East. There is a project on foot now (I may be allowed to say, being president of the company that has this proposition in hand, and knowing from a commercial point of view what is required there) to obtain 32 feet at the Southwest Pass. It will have to be improved in the next five years or the commerce of the Mississippi Valley will be greatly hampered in its movement to the ocean by the shortest and easiest routes.

The Suez Canal had plenty of water once, but the project now is for 94 meters, which is about 31 feet, and they are getting to that point as rapidly as possible. The Nicaragua Canal, as designed by Mr. Menocal, the engineer, at some points has only 28 feet. The Board that has recently gone down there, appointed by the President, has urged very strenuously that there should not be a point in that whole canal less than 30 feet deep. So I think a deep-water harbor on this coast for the purposes of the very business that is coming through the Nicaragua Canal when it is completed, and for the business of the Orient and elsewhere, should have as great a depth as the harbors along the Atlantic Coast.

Coming again to the question of sand drift, I do not care to discuss this matter much further, but I would like to state from my own experience, and also from some two or three allusions to other harbors, what is very likely to happen, in my opinion. I will refer the Board, without going into details, to four harbors whose foreshores have been advanced; that is, where jetties or dikes have been built out from the

coast line on a sandy coast. Their foreshores have been very considerably, and sometimes very injuriously, advanced to the harbor that was built on the other side: Dieppe, page 146 of Harcourt; Calais, page 149; Dunkirk, page 153; Nieuport, page 155, and Madras, page 358.

Mr. Hawgood has given—and if I may use the word ingeniously, I hope he will not be offended—the reasons for his change of mind on this subject of littoral currents along this coast, and has shown you (which is no doubt true) that these various sand spits and sand dunes all move down eastward. But does anybody suppose that those sand dunes and sand spits are moved by the current? They are moved by the wind. We find them all over the world, always moving in the direction of the wind. The prevailing winds at the dry season of the year move the sand along. I have made a diagram here which may illustrate my meaning better than I can in words. We will suppose this is one of these points down the coast. Here is the westward littoral current, which I still believe exists—the prevailing current. Here is a sand spit that is making in the opposite direction. Here is the high-water line. The flood tide comes in and sweeps around into a lagoon on a bluff or caving bank, because this sand spit is crowded this way all the time under the action of the prevailing winds on the shore. Now, there will be some such outlet as that [illustrating by section]. The deep water is always forced against this easterly side by the very fact of this being crowded over against it, and the ebb tide and the flood tide move along it and crowd it still more, and the spit keeps on moving until it meets with some obstruction and then it stops. In dry seasons, when there is very little water inside—very little drainage water—often the winds will carry these sands along so as to close up entirely that outlet. Then, when the drainage water from the rains come down into all these flats it must go to the sea, and if outlets are not found it breaks through. Then this same process goes on again. I believe every engineer that has had to do with littoral work in a current will bear me out in this.

Now, I wish to allude to a matter which the Board is familiar with. It is a small matter and perhaps should not properly be applied to any large condition; but as we are cognizant of the facts, I will mention it. At Port Los Angeles Wharf, as has been described and as the Board has seen, there is a little embankment running out into the water at an angle. On the eastward side of that there has been a slight filling in, caused by the wash of the waves and possibly by this littoral current. I will not say what the cause of it is. On the west side of it there is still a larger deposit than on the east side of that little embankment. The reason for that is this: The waves or currents meet a small obstruction like that extending out from the shore and they bank up all they can against it to the end of it and then pass around and go into the dead water behind and make their main deposit behind this breakwater. That happens most everywhere in the world on a sandy coast. Take the mouth of a sediment-bearing river, and Wilmington has a sediment-bearing river—but in a small degree, I admit—and you will find the same thing. At the mouth of the Mississippi River the westward eddy current banks up on the eastern side of the jetties. At Tampico it banks up on the northern side about 2,000 feet from shore, the littoral sands moving along by the waves and current; but on the other side of the works the alluvial deposit comes into the water behind and extends at the South Pass nearly out to the end of the jetties, 2 miles long, and the grass now grows where formerly there was 20 feet of water. At Tampico it extends 4,000 feet out on a 7-foot jetty, caused by this same action.

I must still adhere to my opinion that any breakwater built out on a sandy coast as this channel is along here will cause a deposit on one side and probably on two sides.

Now, coming down to Wilmington Harbor, or the mouth of Wilmington Harbor, I stated in my direct testimony the conditions that appear on this chart of Colonel Benyard, and attributed the shape of the bar—that is, the bar in front of those jetties—to the same action that exists at other works I am familiar with. I know what happened at those works and I think I know the reason that there was a current in this direction across it from the east to the west; and along with that littoral current comes in the flood-tide current and makes quite a deep channel and a crooked entrance. We have what may be called a crooked entrance at the mouth of the Brazos River, South Pass, and Tampico. It is always on the side of the prevailing current. This is the mouth of the Wilmington River, with contours of various depths. These deep contours that come in around that jetty are due to one or two causes. We might ask right here why does the flood current move in this direction [showing]. It is always impinging on this bar right at that point. Now, when the ebb tide goes out it don't go out here [showing]; why not? Simply because this current that I am trying to impress upon the Board as existing crowds it over here to the west, and Colonel Benyard states that the ebb tides and currents go straight out. What does it do? It don't form a bar here [showing on map]; it forms a bar there [showing on map]; and it is constantly but slowly pushing these contours out and making a bar. The hole which Mr. Moore yesterday spoke of as existing is not simply a hole, but an

unfilled portion of sea bottom. This bar will slowly advance over this deep water out into now dead water if the breakwater is built.

Now with the move of the littoral currents and with the plan provided by the Board of 1891, to admit of the free movement of these littoral currents, this material coming out here could be carried away, because the moment it gets out here [showing] it is caught by the prevailing littoral current and moved westward. When that current is reversed, and I acknowledge and must acknowledge it is often reversed, that harbor would be kept open. I believe just what I stated before the Senate committee, that the Boards of 1891 and 1892 were in a dilemma; "they were between the devil and the deep sea." Those were the words I used, and I insist upon it at this time.

We have had four plans for a harbor at San Pedro by prominent engineers; and the very fact that it has required four projects to meet the difficulties is proof of the extent and size of the difficulties. Nobody has ever suggested but one plan for Santa Monica, because the conditions are simple.

I wish to make just one remark in reference to detached breakwaters. I think I stated that the blue prints and descriptions which I gave to the Board were made by an investigator in whom I have a great deal of confidence as a painstaking and careful man. I said to the Board that there were in the world quite a number of detached breakwaters. I did not intend to make any comparison in a general way with the conditions either at Santa Monica or San Pedro. I believe there are on the plans submitted 33 detached breakwaters, and I wish to modify one or two of my former remarks. At Ballona there has never been a detached breakwater built. My assistant did not know that; he took it from the records, but it has never been built there. I think the breakwater shown on the chart on the north has never been built. The great Carnot breakwater on the south, which I had the pleasure of examining myself, one of the finest works in the world, is all that has been built there. At Colombo, I am not sure whether the detached breakwater marked "proposed" has ever been built. That can be ascertained. I think Mr. Morison has seen the breakwater.

Mr. MORISON. I have never been at Colombo.

Mr. CORTHELL. Excuse me; I thought you had. One more explanation is necessary. The Delaware Breakwater as planned, which is on these blue prints as they came to me, don't show the breakwater now to be put under construction, which is authorized in this act to cost \$4,000,000 or \$5,000,000; but since I have been here I have received from the Chief of Engineer's Office the call for proposals and plan of it. I have had it put on this chart and you will find it up by another breakwater. There was no room to put it on by itself. There are one or two corrections I wish to make. I think the Board in examining it will find that although there is no breakwater there with all of its conditions that is exactly like Santa Monica (it would be a miracle to find two sets of similar conditions existing anywhere), yet the general system of comparison exists; and you will find breakwaters practically parallel to a rectilinear shore and you will find several that do not have end protections. There are piers built out which may offer more or less protection. But that matter I will leave to the Board to decide.

Now, I wish to discuss Mr. Moore's statement made yesterday again. I think it is in the sixth day of the hearing. Speaking of the normal and oblique swell, I made the point in my original remarks that the direction of the swell upon that breakwater (Port Los Angeles) was more favorable for the maintenance of the work than upon the breakwater that the Board proposed in 1892 at San Pedro.

It is very hard for anyone to give up the results of his own experience in fighting waves by means of breakwaters. I never could be convinced, even if it was stated by Mr. Stevenson, or by anybody else, that an oblique movement of heavy waves against a breakwater is better for the breakwater than the normal one for reasons which I gave in my remarks. I wish to call your attention to the illustration which Mr. Moore used in regard to the Wick Breakwater. The obliquity is so small that I would not suppose that it would make very much difference either way; it strikes the breakwater nearly normal out near its end and 90° only from normal landward, and of course the chock of the waves landward or near the land in shallower water would be much less, no matter what the angle is, than it would at the end of that heavy breakwater. I was very much surprised at a statement of fact in reference to the movement of a block on the end of that breakwater. I had known something about it. I had been in Mr. Stevenson's office, or his son's office, and have known about this work and the destruction caused at the end of that breakwater by almost marvelous effects of the sea. It is a very peculiar condition. There is, perhaps, what you might call a funnel-shaped mouth; that is, the Wick Harbor has about the same width of entrance that it has depth to the same fathom line. This harbor here [pointing to Santa Monica] has about 29 miles across between the points and 12 miles on the ordinate. Now, Mr. Moore states, "a block of concrete weighing, I think, 2,600 tons, was moved bodily and thrown over into the inside of the breakwater."

Now, as far as I can get at it, the facts are these. That block weighed 1,350 tons, instead of 2,600 tons.

Mr. MORISON. That block of concrete?

Mr. CORTHELL. Block of concrete.

Mr. MORGAN. What was the section or size of it?

Mr. CORTHELL. I have it; I will give it to you. It was 45 feet wide, 21 feet high, and 26 feet long. There had been great trouble at the end of the Wick Breakwater and they had leveled off a base to put this great block on. During this tremendous storm this block was moved by the impact of the waves. It was done little by little, shock after shock, during this tremendous storm. The block was moved little by little, and finally tilted up and slid off into the harbor. I don't think the expression "thrown into the harbor," no matter by whom it is used, is the proper word to use. It didn't throw it; it slid off.

I believe that is all that I have to review of Mr. Moore's testimony. Now, there are some points which have been stated by Mr. Gibbon in which I am personally concerned, because he has used my language in one or two cases, and I wish simply to correct him in one instance. It will need a little explanation that is not germane to this subject at all, but I want to be on record as having made a correct statement, or approximately correct.

On page 387 of the testimony yesterday, sixth day, Mr. Gibbon quotes from an abstract of some remarks which I made before the House committee on February 28, 1896. Mr. Hood and myself appeared before that committee and went into details with maps and charts, and then at the request of the committee I wrote an abstract of those remarks, so it would be epitomized for them. It was an entirely oral hearing. I believe we had no written notes, but in the abstract I wrote this: "As a general description of the situation, southern California, of which the city of Los Angeles is the center of population and trade, has increased in population and similarly in all other directions, about 350 per cent in the last fifteen years, and Los Angeles is only 12 miles from Port Los Angeles, where it is proposed to build the breakwater and make a protected harbor." He simply left out the word "about" and it is quite material in this case. That was not supposed to be a comparison at all of distances to San Pedro. It was the general situation referring to the map which had been on the wall before that committee showing the urban distances in direct lines; not by the railroad lines.

I will also refer to the map which I did not make myself, but which I presume to be approximately correct.

Mr. MORISON. You mean the map behind you?

Mr. CORTHELL. No, sir; the map I filed with the Board, which is No. 17 of the list of exhibits I filed with the Board showing urban distances, simply to show the movement of population to Santa Monica.

I have only one more matter to discuss and that is in reference to the legislation which Mr. Gibbon yesterday stated I had not given correct views of. I would not refer to it again, except that he has done so. There is an important matter connected with it which I would like to bring out and to emphasize the remarks which I made the other day. I will restate those again in order that there may be no doubt about my meaning. In my opinion, and from the records, the meaning of the Wilmington item in the river and harbor act is as follows, interpreting it now from discussion of the hearing before the Senate Committee on Commerce and in the Senate and the report of the conferees to the House:

The entrance channel of the inner harbor will, according to the present project for obtaining 18 feet depth, estimated to cost \$392,000, answer all purposes of the ordinary trade of this part of the Pacific Coast. If the outer deep-water harbor, costing \$2,900,000, should be located at San Pedro, then the present depth of the inner harbor and of its entrance channel, about 14 feet, will answer all local purposes, and no more money is to be expended upon it, according to the recent action of Congress, except, of course, to maintain the channel and the works. The business must, for the purposes of any more extended local facilities than the present inner harbor can furnish, go into the outer harbor; but if the deep-water harbor should be located by this Board at Port Los Angeles, then Congress was willing to spend on the inner harbor, for the benefit of the commerce there at Wilmington, \$392,000 to secure 18 feet depth.

Now, in the Congressional Record of May 6, 1896, page 5347, Fifty-fourth Congress, first session, will be found the item for Wilmington Harbor, which had been agreed upon in the Senate committee and so reported to the Senate. It reads exactly word for word with many items in the river and harbor bill. In other words, it is the standard form of the language for beginning a work under the continuing contract system. It appropriates a certain amount of money to begin the work with and then goes on in this way: "Provided that contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate" a certain amount. The same language is applied to all such items.

That item passed the Senate, and the Santa Monica or Port Los Angeles item was, by consent of both sides, knowing that there was going to be (I will use the word properly) a fight over it, postponed for consideration to the end of the whole bill, to be taken up separately and discussed, as it was, for five days. Then the river and harbor bill, with its provisions in regard to the deep-water harbor and the provision for this Board, went to the conference committee, and they agreed and disagreed for ten or twelve days, if I remember correctly. Then it was finally reported to both Houses, was examined and signed. If the Board cares to read the Congressional Record, it will find what I am now stating to be correct. On May 23, page 6151 of the Congressional Record, the river and harbor appropriation bill was called up and Mr. Hooker, the chairman of the River and Harbor Committee of the House—well, I will read it just as it is:

"Mr. HOOKER. Mr. Speaker, I present a conference report.

"The report of the committee of conference was read.

"(For conference report see Senate proceedings, May 22.)

"Mr. HOOKER. Mr. Speaker, I move to concur in the report, and I desire to send up a statement to have read."

Mind, this is a statement at the end of the whole business, that is, at the end of the controversy in reference to this deep water and Wilmington Harbor, and other matters. It closed up the bill, in other words:

"(Reading) The statement of the House conference was read as follows:

"The amendment for deep-water harbor at Santa Monica or San Pedro provides for a cash appropriation of \$50,000 to defray the expenses of the Board for examining the projects and making plans and estimates for the improvement; and after their decision the Secretary of War is authorized to enter into contract for the completion of the project at a cost not to exceed \$2,900,000. The amendment relative to the inner harbor at Wilmington provides that in the event the Board shall decide to locate the outer harbor at Santa Monica, then the Secretary of War is authorized to contract for the completion of the inner harbor at Wilmington at a cost not to exceed \$392,000, and in the event that the Board decide to locate the outer harbor at San Pedro this contract for Wilmington shall not be entered into."

That is the report of the conference signed by W. B. Hooker, Binger Hermann, and T. C. Catchings, managers on the part of the House.

Now, Mr. Chairman, I have endeavored to give you the facts which led me nearly three years ago to form my opinions on this matter. I have seen nothing from that time to this to change my mind. I believe that Port Los Angeles is the place to build this deep-water harbor and have endeavored in my remarks and in this discussion to give you the reasons for the basis of my belief.

Mr. MORISON. What do you consider the boundaries of Port Los Angeles?

Mr. CORTHELL. I have no definite idea of that. I suppose it was so named because there was a pier located there for commerce, but what its legal or commercial boundaries are, I certainly do not know. My opinion would be that it would cover any reasonable or proper development of commercial facilities at the point or in the vicinity of the present wharf as distinguished from Santa Monica.

Mr. MORISON. You think that a breakwater built in front of Santa Monica and not covering the existing pier would be outside the limits of the law?

Mr. CORTHELL. Yes, sir; for the reason (and you will find in the records and in the petition that was offered to Congress, and in the wording of the matter throughout the discussion) that Port Los Angeles was pretty clearly defined, although its limit is not given. It was distinguished from Santa Monica.

Mr. MORISON. To put it briefly, you would consider that any continuous breakwater which included in its protection the existing pier would be at Port Los Angeles?

Mr. CORTHELL. Yes, sir.

Mr. MORISON. And that one that didn't include in its protection the existing pier would not be at Port Los Angeles?

Mr. CORTHELL. Yes, sir; I am very certain on that point.

Mr. MORISON. What would you consider the limits of San Pedro?

Mr. CORTHELL. Any improvement that would make a protected harbor that would accommodate the commerce for which it is provided; that is, a harbor for commerce and of refuge.

Mr. MORISON. Anywhere in San Pedro Bay?

Mr. CORTHELL. No, sir; I think not. That is too general a term to apply to this. I don't think that was contemplated at all. There never has been any discussion either outside or inside of Congress that would warrant any such interpretation as that in my opinion.

Mr. MORISON. You would consider that a breakwater there could not be put very far away from the entrance to Wilmington Lagoon?

Mr. CORTHELL. No, sir; I don't think it was ever intended to get away from Port Firmin. There never has been any thought of that that I know of.

Mr. RODGERS. You have made several allusions to channel depths of 30 feet being prepared. I would like to ask you what depth of ships you infer are to be provided for? What draft?

Mr. CORTHELL. Twenty-seven to 28 feet. By the way, right on that point, if you will allow me to make the remark, one reason why they want 30 feet at Boston is that it depends a great deal upon the tide, of course, in reference to the harbor entrance. It is about 9 feet at Boston; at New York, say, 5 feet, and on the Gulf, at the mouth of the Mississippi, 14 to 18 inches. I want to say this, that there has gone out of Boston Harbor one (possibly more) ship drawing 31 feet. The reason they can go out with the present depth of 26 feet is that they take advantage of the tide.

Mr. RODGERS. Those are low-water depths you refer to?

Mr. CORTHELL. Yes, sir; low water.

Mr. MORISON. Can you give the name of the ship?

Mr. CORTHELL. It was one of the Leyland Line. This was stated by Mr. William H. Lincoln, president of that line, and I will state for your information that she carried over 10,000 tons of cargo.

Mr. RODGERS. Suppose a ship of that depth should be anchored in an outer harbor, what depth would be required?

Mr. CORTHELL. I am not a nautical expert or familiar with those matters, but such depth of entrance channel as I have described would not answer in that case, of course. I should think there ought to be 10 feet under a large vessel anchored out in any protected harbor so that she may clear her anchor.

Mr. RODGERS. Six or 7 fathoms?

Mr. CORTHELL. Yes, sir.

Mr. RODGERS. What depth is there between the breakwater at Port Los Angeles and the pier?

Mr. CORTHELL. The pier, I think, is in about 34 or 35 feet of water, and that breakwater runs from about $7\frac{1}{2}$ to 8 fathoms. If I may be allowed to make a suggestion, my own opinion is that that breakwater ought to be moved out a little. I think it would be better to shorten the work a little and put it out in a little deeper water.

Mr. MORGAN. Mr. Cortbell, if I recollect rightly, you stated that this map was before the Congressional committee?

Mr. CORTHELL. This map [pointing to a large map of Santa Monica and San Pedro Bay]?

Mr. MORGAN. Yes, sir.

Mr. CORTHELL. It was before the Senate committee. No, it was not before the Senate committee, it was before the Senate. The map was not there at the time of the discussion. That map was before the Senate and the Coast Survey map and several others.

Mr. MORGAN. Were the sites for the suggested harbor substantially presented as they are presented here?

Mr. CORTHELL. Yes, sir.

Mr. MORGAN. Then the act of Congress making the appropriation was based upon an approximate location such as is here at this time.

Mr. CORTHELL. Yes, sir; it was.

The CHAIRMAN. That map was before the Senate at the time of the discussion in the Senate?

Mr. CORTHELL. Yes, sir.

Mr. HOOD. Mr. Chairman and members of the Board, Mr. J. A. Muir and some of his immediate assistants will be presented, with your consent, next in rebuttal, and I would like Mr. Muir to be permitted to ask questions of those he presents.

Mr. MUIR. With reference to the *Enoch Talbot* discharging her cargo at Port Los Angeles I would like to read a letter in rebuttal from Captain Edwards of the British ship *Port Crawford* that left Port Los Angeles yesterday. It is also in rebuttal of Mr. Weldt's statement in regard to the anchorage. This letter is a copy of a letter that was addressed by Captain Edwards to the editor of Lloyd's Shipping Index, London, England.

"DEAR SIR: I beg through the medium of your paper to express my admiration for the facilities for handling ships and cargoes at Port Los Angeles. Ships are discharged rapidly, ballast is furnished promptly, and everything that can be done is done for the best interests of the ship. The anchorage is the best, and altogether I consider Port Los Angeles a safe port and would gladly accept a charter for this place at any time.

"Yours, respectfully,

"W. D. EDWARDS,

"Master of the British Ship *Port Crawford*."

This letter is dated December 28, 1896.

Mr. W. D. Weldt, who is pilot at San Pedro, made a statement that he had been a pilot at San Pedro for fifteen years, and as such gave evidence with regard to certain

ships, some of which I knew as a fact had been there before he was ever pilot. Therefore I telegraphed to the secretary of state, Mr. L. H. Brown, and asked him for the dates of Mr. Weldt's appointment, and this is his reply:

"SACRAMENTO, December 29, 1896.

"Mr. J. A. MUIR:

"First appointed, 1886; removed one year later, June; reappointed, October, 1887.

"L. H. BROWN."

That is a little over ten years. Captain Smith testified that he was master of the steamer *Whitelaw*, a wrecker. I telegraphed to Thomas P. H. Whitelaw, owner of the *Whitelaw*, asking him what time he was captain of that steamer. His reply is dated San Francisco, December 28:

"Mr. J. A. MUIR:

"I don't remember ever having a Captain Smith in my employ in steamer *Whitelaw*.

"THOMAS P. H. WHITELAW."

Now, if there are no questions to ask, I will call Mr. Hyde.

Mr. MUIR. What is your name?

Mr. HYDE. M. J. Hyde.

Mr. MUIR. What is your occupation?

Mr. HYDE. Engineer of machinery and motive power at Port Los Angeles.

Mr. MUIR. Were you at Port Los Angeles at the time Captain Johnson was there with the bark *Enoch Talbot* discharging lumber?

Mr. HYDE. I was, sir.

Mr. MUIR. Captain Johnson stated that he was delayed at Port Los Angeles for some twenty-two or twenty-four days. Will you please state if you know the cause of that detention?

Mr. HYDE. I remember the arrival of Mr. Johnson and his departure. He arrived November 13 and sailed December 12, 1895. Mr. Johnson was not detained there for any unreasonable cause or from any disadvantages at the wharf. The reason was his poor appliances for discharging his vessel and inattention to business himself. His engine and hoisting gear were poor, and he was placed at a great disadvantage, one day particularly that I know of, by his feed-pump failing to work for his boilers in supplying the necessary water to feed his boiler with. His detention was on account of poor, worn-out material, as well as inattention to business generally, in looking after the appliances with which he had to discharge his vessel. He didn't watch his crew and attend to them. He was passing considerable of his time on shore. Besides, he was at a great disadvantage in handling the long lumber with which his ship was loaded. He had long stringers, 7 by 16, 32 feet long, and some longer. He had a small hatch, and the stringers were on top of the cargo in the hold of his ship. In bringing them out in swing loads 4 and 6 feet at a pull would take considerable time, as well as not rendering the necessary assistance to his crew in getting his lumber out.

Mr. MUIR. During Captain Johnson's stay there, what was his condition with regard to sobriety?

Mr. HYDE. Well, I would judge that it was not of the first class; that the attractions were greater ashore than what they were to his business.

Mr. MUIR. I will now call Captain Dornfeld. Will you please state to the Board, Captain, what you know about the case of the *Enoch Talbot* and her delay at Port Los Angeles while discharging lumber?

Captain DORNFELD. The only reason that I know of that he didn't make better progress with his discharging was Mr. Hyde stated. His lumber in between decks was such a length that it was bad to get out of the main hatch. He had a small hatch, as near as I can recollect probably 10 by 12, and on account of the hatches being small it was quite difficult to get the lumber out. Another reason that the ship was as long as she was discharging was due to Captain Johnson not paying attention to his shipping business, or I would rather state that most of the time he would not be down to the dock at all attending to his ship. He would be off somewhere else. Of course, it is a captain's privilege to do so, but invariably I have found when the master is not around and attending to his duty no one else will. As far as his statement goes that the sea was so rough that he could not work there it is absurd. That is all.

Mr. MUIR. Captain, you heard the statement made by Mr. Davis with regard to the crew for the *Fernbank*. Will you please state to the Board what you know with regard to that matter?

Captain DORNFELD. The captain of the *Fernbank*, Captain Henderson, and myself were in Santa Monica when Mr. Davis came down on the noon train or the 11 o'clock

train. The first knowledge I had that any men were being sent around from San Pedro for the ship was at that time. He said that he had a crew coming down on the next train, and that they were not in a very good condition, meaning by that that they were more or less in liquor. I asked him how many men he had, and as near as I can recollect I think he said thirteen or fifteen and that he wanted our boat—that is, the Southern Pacific boat—or rather he wanted to know how to get them out to the ship. I told him that the *Ferabank* was quite a distance off the dock and I didn't think he could possibly hail her. Then he wanted to know whether he could not get our boat. We have a large boat we use for running lines and sundry purposes. I told him I didn't think it was safe for him to have our boat; that if his sailors were to be got off to the ship that day the chances were, in the condition they were, that we would have to put a crew in the boat to pull them off. Now, the Southern Pacific or myself, as near as I know, have no arrangements with Mr. Davis or anybody else to transport crews, especially in such condition as they were supposed to be in, with their bag and baggage, off to the ships. I didn't want to insult the man by coming right out and saying that his crew were in such state that they would endanger their lives, so I simply told him that I didn't think it was safe for fourteen or fifteen men. He wanted the boat and said that they could pull themselves out. If I had let them have our boat the chances are if there had been any mishap to them, which there no doubt would have been, they would have come back on me or the Southern Pacific for damages, and we would have had a lawsuit and so on. So I told him it was not safe for him to take his crew out that day. They brought them down in the afternoon, just as he stated, and they were in anything but a fit condition to go out. We kept them there until the next morning, and even then they had to club the men and throw them in the boat to get them off. As far as the weather went, I would not hesitate for a moment to take two or three men in our boat and go out there at any time, especially the day they left.

Mr. MUIR. Mr. Davis stated the waves were running 10 feet high, if I remember right?

Captain DORNFIELD. I am sorry that Mr. Davis states such things as that. I don't think Mr. Davis knew anything about how high the waves were running. They certainly were not over 3 feet, and if I wanted to go off to the ship, I would not be scared at all to take a crew out and do our business. Take that day when the *Dunboyne* had to be towed away from the dock. We had four men in the boat and they were under lines to the *Corona*. I think that is the severest storm we have had at Port Los Angeles since I have been there.

Mr. MORISON. When was that?

Captain DORNFIELD. *Dunboyne*, in 1895, I believe.

Mr. MUIR. It was March of this year.

Mr. BURR. About how high were the waves then?

Captain DORNFIELD. The *Dunboyne*?

Mr. BURR. Yes, sir.

Captain DORNFIELD. As near as I could judge, between 4 and 5 feet. The wind was from the southeast, hauling to the southward. It is not a very pleasant thing to take a drunken lot of sailors out in a boat with their baggage and bags and things, and nobody to manage the boat but themselves. In reference to the testimony that Mr. Withers gave here of bringing those men around and stating that he got nearly over to Santa Monica, I would say that I saw him that evening, and to me he stated that he never got further than Point Firmin. In fact, when a man has a small boat, 28 feet long, leaving San Pedro and getting outside, and the men in not a very good condition with their sea traps on them, I can not see why a man if he wants to make a port should wait until the sea gets 10 feet high. It is certainly a fact that no small boat can live in such a sea, in the condition that boat was in.

Mr. MUIR. You succeeded Captain Polhamus at San Pedro in handling the business of General Banning, did you not?

Captain DORNFIELD. Hardly succeeded Captain Polhamus. Captain Polhamus was engineer there, as near as I can recollect, before I came, and afterwards they put him on as steamboat captain. My business at San Pedro has been stevedoring and handling shipping outside. Captain Polhamus's business was principally to tow lighters from the ships backward and forward.

Mr. MUIR. Your business in handling the lighters and stevedoring ships on the outside would necessarily make you familiar with the currents? What is your experience at San Pedro Bay as to the currents?

Captain DORNFIELD. I have seen the current run to the eastward and I have seen the current run to the westward, both ways. I have noticed lots of times that while discharging ships, especially in the early morning until the westerly winds would set in at 11 or 12 o'clock, before they would blow home there, that the ships would swing quite often with the lighters on their starboard side up toward Point Firmin; and I have known a number of cases where we have had to take the lighters away from alongside the ships to keep them from pounding their own selves to

pieces, and also the ships, which would simply demonstrate that there was a westerly current. I can recollect the ship *W. H. Campbell*, Captain Hawthorn, as lying in such a condition for fully eleven days that we could not put a lighter alongside of her.

Mr. MUIR. Owing to the current?

Captain DORNFELD. Owing to the current the most of the time.

Mr. MUIR. Which way was that current?

Captain DORNFELD. Up to the westward. Then toward the noon hour, when the westerly winds would blow in, that would naturally straighten the ships out and swing them down toward Long Beach.

Mr. MOORE. Ships will swing, where there is no current, with the wind and tide, will they not?

Captain DORNFELD. Yes, sir. I would like to state that as far as the ship swinging with the tide is concerned, those ships would swing mostly in the morning before the wind set in—from early in the morning until noon. Now, if it was only tide, it would do so at other times as well; but my experience in that matter has been that the ships would swing up pretty nearly every morning before the trade winds set in toward Point Firmin and straighten out toward Long Beach when the winds set in. That is, when the wind would have hold of her rigging, yards, and masts and her hull. Now, if it was the tide, they would straighten out sometimes one way and sometimes the other.

Mr. MOORE. Wind and tide, then, do change the position of the ship?

Captain DORNFELD. Why, of course; certainly.

Mr. MOORE. Did you ever have any difficulty in taking passengers on and off at Port Los Angeles? Have you ever had occasion to take them on and off in a sling?

Captain DORNFELD. Yes, sir.

Mr. MOORE. What ship was that on?

Captain DORNFELD. The *Corona*.

Mr. MOORE. What was the occasion of that?

Captain DORNFELD. It was on the same day that the *Dunboyne* got into trouble. The wind was from the southeast.

Mr. MUIR. I beg to interrupt the witness. That is new evidence entirely with reference to the *Corona*, but I don't care anything about it.

Mr. GIBBON. We didn't see that the matter of the current was rebuttal. We have a dozen more witnesses we could put on but we don't think it is rebuttal.

The CHAIRMAN. You can answer that question. You need not go into any explanation of it, Captain, but just answer the question.

Captain DORNFELD. Yes, sir; I have.

The CHAIRMAN. Give the date.

Captain DORNFELD. That date was the same date as the *Dunboyne* trouble, and I would like to state that it was not on account of the sea at all or the wind at Port Los Angeles; that those passengers could have gone on board on the gangway. It was Captain Hall, and he has on sundry occasions done things which were anything but seamanly; he could have hauled his ship up alongside of the dock.

Mr. MORISON. Who is Captain Hall?

Captain DORNFELD. Of the *Corona*?

Mr. MORISON. Commander of the *Corona*?

Captain DORNFELD. Yes, sir. The passengers could have walked on board. They could have had the gang plank out just as well as not.

Mr. MUIR. Captain Dornfeld, it has been testified here that the ships at San Pedro went ashore on account of bad management. You were there at the time these ships went ashore?

Captain DORNFELD. Yes, sir; I was there since 1884.

Mr. MUIR. Will you please state for the information of the Board what you know with regard to the bad seamanship referred to.

Captain DORNFELD. Well, all I know about those ships is simply this, that they went ashore dragging their anchors. I hardly think it fair to accuse masters and officers of our shipping of going ashore in a gale of wind on account of bad seamanship. I think the best judge about anything of that sort is the insurance company. All those ships were insured, and as near as I know (and as is on record) the insurance companies paid the insurance and the men were exonerated. If they went ashore through bad seamanship, they certainly would not have given their men command of their ships again and the companies would not have paid the insurance. They simply went ashore because there was too much sea and too much wind, and some of them were anchored in bad holding ground.

Mr. MOORE. If a master allowed his anchor to get foul and dragged on that account—

Captain DORNFELD. I think when a master has got sense enough to take his ship around Cape Horn time after time, and bring his ship in port, it is self-evident he has got sense enough to know when his anchors are fouled.

Mr. MOORE. Suppose that he was not on the ship at the time?
 Captain DORNFELD. That doesn't cut any figure. The chief officer then has charge of the ship.

Mr. MOORE. Suppose only one man was on board at the time?
 Captain DORNFELD. There never has been a ship go ashore at San Pedro where there was only one man on her.

Mr. MOORE. I was simply asking that question.
 Captain DORNFELD. I don't know about that.

Mr. MORGAN. Of the various wrecks that have been spoken of, about where were they on the coast? Will you please point out where they went ashore?

Captain DORNFELD. Well, the *Kennebec* went ashore here [showing on map, near Deadmans Island]. The *America* struck the bell-buoy rock and drifted down on to Deadmans Island. The *San Luis* went in here [showing on map]. The *R. P. Buck* was anchored here [showing], and drifted in here [showing], and pounded herself to pieces there.

Mr. MORGAN. Were there any more than those four you spoke of?

Captain DORNFELD. I will have to think that over. There has been lots of them dragged there, but not to my knowledge have they gone on the beach. Those I have actually seen, and I think in the case of the *Kennebec* and the *Richard P. Buck* I was the first man to go over the bar and go on board of them after the accident happened.

Mr. MORGAN. They were driven in to those points?

Captain DORNFELD. Yes, sir.

Mr. MORGAN. What would be the direction of a storm that would carry those vessels in that way, dragging their anchors?

Captain DORNFELD. The storm was from the southeast the day before. It blew all night and hauled around to the south-southwest next morning, and it was then when those ships went ashore, sometime early in the morning. In the case of the *Kennebec* and the *America* the captains were on shore and could not get off to their ships. It was impossible for them to do so. I think those gentlemen would have got off, but they could not do so. The captain of the *Kennebec* had his own son on board as boatswain.

Mr. MORGAN. Where did they go ashore?

Captain DORNFELD. Right here [showing on map]. He remarked that all he cared about was to have his son out of her. He couldn't do anything more to the ship. They had both anchors out. We could see from the beach that they had both anchors out.

Mr. RODGERS. About what distance did they drag?

Captain DORNFELD. As near as I can recollect, from where they were anchored to where they went ashore it is probably three-quarters of a mile.

Mr. MOORE. You say the *Buck* pounded herself to pieces?

Captain DORNFELD. She pounded herself so much that she had twenty-odd feet of water in her. Her hull was split fore and aft.

Mr. MOORE. She went to sea again, didn't she?

Captain DORNFELD. Oh, no. They towed her off so that if she went down, she would clear of the harbor. We kept the pumps going night and day, and at the same time discharged the cargo out of her. It is a matter of record. You will find what damage there was from the underwriters. They have that.

Mr. MOORE. I understood you that she pounded herself to pieces.

Captain DORNFELD. That is what I would call pounding herself to pieces, when she has 20 feet of water in her. I don't mean to say that her keel was floating one way and her fore-castle the other. If I recollect rightly they had to tow to San Francisco light.

Mr. HOOD. If you will allow me, I will occupy your attention for a few minutes.

First in regard to petitions. I suppose that if this were a court of law and the witnesses under oath that it would be considered a novel proceeding to present to the judge a petition as to his decision. I have never heard of such a case. It is not a court of law and the witnesses are, unfortunately, I think, not under oath. I very much wish that every witness here could have been under oath. Not that I wish to say that there have been malicious, intentional false statements which if made under oath would be perjury carrying the proper penalties, but it would have made all parties (and that is liberal enough I think) more particular to say what they knew instead of what they thought and wished.

We have, as you know, presented no petitions whatever—announced that we had a sort of contempt for petitions. I use the word "contempt" advisedly in this connection.

But as a petition was presented by the advocates of San Pedro, I felt a curiosity to inquire into the composition of the petition; and I asked Mr. Springer, the local freight solicitor for this region, working for the Southern Pacific, if he would look it up and see who the people were that had signed the petition. I knew some of

them to be men of prominence and men that are respected; but some of the names I really was not familiar with. Now, I will not take up your time—

The CHAIRMAN. Mr. Hood, as to the matter of petition there is really nothing to rebut, as I see.

Mr. HOOD. I think there is something that ought to be filed.

The CHAIRMAN. Anything you wish to file you may.

Mr. HOOD. I think I ought to give the essence of it. It was stated, I think, or implied, that the petitioners really represented the business community of Los Angeles. Am I correct?

The CHAIRMAN. A statement to that effect was made, but how far it is necessary to go in rebuttal of that is not altogether clear in my mind.

Mr. HOOD. I think it is ridiculous to rebut anything of that kind, as I have said, and as I do not enjoy very much speaking before an audience in any case, if you choose I will file it without reading, or I will simply read you the classification of the signers and then file it for the investigations of my opponents. In the petition that was presented on the 26th the signatures can be classified as follows:

Wholesale merchants	18
Retail merchants	78
Banks	11
Real-estate agents	18
Clerks	54
Professional men	8
Capitalists	8
Farmers	5
Miscellaneous	15
Storage and commission	5
Lumber firms	12
Contractor and builder	1
Country signatures	15

Of the wholesale merchants who signed the petition referred to presented December 26 there is only the name of one firm who have, so far as I can find out, imported any goods direct from a foreign country on vessels landing at a southern California port. Of the wholesale merchants doing business in this city who do import direct from foreign countries there are ten whose names do not appear on the petition. In fact the names of the firms doing the largest business in Los Angeles do not appear in that petition at all.

I will not burden you, Mr. Chairman, with reading this in full. I will file it. That is the substance of it, and I will thank you to allow me to file it. It is open to the inspection of the other side, and I have made five copies of it.

As I have been, so to speak, conducting the Santa Monica side of this controversy, so far as the Southern Pacific Company's interests were concerned and the Southern Pacific Railroad interests were concerned in the matter, I think, if you will allow me two minutes and a half or three minutes—possibly four minutes—of what may be called a general presentation so far as we wish to do it, that it might be proper, with your consent, and might shorten the proceedings somewhat. I hope so. Can I do it?

The CHAIRMAN. Go ahead, Mr. Hood.

Mr. HOOD. First, it is perfectly obvious, I think, to all parties here who have technical knowledge that the following considerations are true:

Rebuttal as to technical matters—not to criticise the admission of rebuttal, but as a general proposition—in a hearing of this character seems superfluous on the surface. If either side have inadvertently been in error as to the facts, your Board will arrive at the truth by your own investigations and knowledge. As to argument before you, I see no room for argument of ascertainable facts; and you yourselves will ascertain any necessary facts not brought before your attention at this period.

As to summing up the technical evidence, it would seem to be improper for me or anyone else to offer to do what is entirely a part of your business, and I have not noticed in this hearing much other matter which comes within the class of evidence which you asked us to present when the hearings commenced.

Any feeling of unfairness that has manifested itself toward the corporation that I represent I am sorry for; sorry to have had it said. I do not lay it up, and I will say nothing in rebuttal of that; not one word, excepting that I hope the time will soon come that all who have said or thought or felt anything of this kind will be more friendly and kindly toward us.

If you will allow me, Mr. Chairman, I would like to thank the advocates of San Pedro for the few instances that they have presented as to waves at Port Los Angeles which would make a breakwater there very desirable in order to make a harbor at Port Los Angeles more complete than it is now. I desire particularly to thank my opponents for the manner in which they have accommodated us by looking up these matters at a cost of considerable time and expense.

The most important point commercially that we have called attention to and that I will mention here, is that with a certainty of the principal coastwise steamship, freight, and passenger business handled at the northernmost available point under consideration by this Board—and that is Port Los Angeles—no railroad or other corporation can afford to build the necessary expensive wharf to utilize a deep-sea harbor there at Port Los Angeles or San Pedro and build it in a place where they will fail to get their due proportion of the deep-sea business and their due proportion of the principal coastwise business. It is quite obvious that the corporation claiming the wharf at San Pedro will lose almost all of the choice coastwise freight and passenger business. Why? Because Port Los Angeles exists, and it will always exist.

Long towage, and this is in rebuttal slightly, has in some instances been made at Port Los Angeles. It has been done for convenience; not from necessity. I certainly do not understand the San Pedro advocates to mean that Santa Monica Bay is so entirely free from wind that a sailing vessel can not generally sail in it either to or out from Port Los Angeles if expedient. I have been very much interested in that point in their evidence, because I had supposed there was a great deal of wind there occasionally, and almost all the time a good sailing wind.

Now, Mr. Chairman, thanking you for your kind attention, and if you will allow me, emphasizing and repeating my opinion of the utter absurdity of anybody summing up technical evidence for your Board, the ridiculousness of the proposition, and for that reason I will not undertake it, to say nothing of other reasons, I will close, having it clearly understood that I close the Santa Monica side so far as it relates to the presentation of it by any person connected with the Southern Pacific Company or the Southern Pacific Railroad Company—either company, both companies. But I have no right, no claim, to speak for any other interests in Santa Monica, and it rests with yourselves to call on the representatives of any other interests to appear here in rebuttal, or otherwise, and I shall be pleased myself to hear anything of that kind; but I wish right here to disclaim for the interests that I represent any responsibility whatsoever for any summing up of technicalities, the summing up of commercial matters, business interests, and the like. Of that I say not a word, but my side will not be responsible for and will not defend or in any way have anything to do with any summing up of technicalities before your Board whatever in our interest.

Mr. MOORE. May I ask you some questions? You said something about the height of waves.

Mr. HOOD. When?

Mr. MOORE. In your paper just now, as to the height of the highest waves.

Mr. HOOD. Oh, yes.

Mr. MOORE. I have before me a statement that the highest waves we have had were 14 feet. What would you say as to that?

Mr. HOOD. From whom? When?

Mr. MOORE. It is in the statement of remarks by E. L. Corthell and William Hood, 28th of February, 1896, and it is set down as having been stated by Mr. Hood.

Mr. HOOD. No; there was nothing of that kind ever stated there. If it is printed that way it is an error. I will say that that statement was made before the House committee at a time when the rather celebrated Cuban debate was about to start in the House, and the members of the committee were exceedingly desirous of hearing the debate, and they granted us fifteen minutes each and said we must talk fast. The stenographer became a total wreck and could not follow me at all, and I have a dim remembrance of having said something about the wharf being very safe for waves of that kind. I may have said—really, I don't know, but I certainly never said anything about waves 14 feet high. If it is so stated there it is a curiosity.

The CHAIRMAN. What page is that?

Mr. MOORE. It is on page 14. In order to do you perfect justice I will show you what it says.

Mr. CORTHELL. Mr. Chairman, perhaps I can explain this matter.

Mr. HOOD. I don't remember anything about it.

The CHAIRMAN. One moment. Wait until Mr. Moore gets through.

Mr. CORTHELL. I thought possibly I could relieve the situation by a short explanation.

Mr. HOOD. I will say, Mr. Chairman, that if I could have truthfully stated that the waves were 14 feet high then, and if now I could truthfully state that I knew of any such thing, I should be very glad to, because the whole trouble of the situation heretofore has been the difficulty of proving that we needed a breakwater anywhere. You people here in southern California have come very near losing an appropriation for a breakwater by the respective sides trying to prove that they never had any waves.

The CHAIRMAN. I understand your answer to be, if this was put 14 feet high it is a misprint?

Mr. HOOD. Certainly. But I do say I wish I could have truthfully stated it, and I wish I could now, but I will not and can not. And if it will do the other side any good for me to say that possibly I may sometime see them that high, that is the furthest I can go.

I am willing, Mr. Chairman, to answer any questions whatever outside or inside the testimony if you consent, but as there seems to be some informality here I am a little curious as to whether I am being cross-questioned on our evidence or on literature of the last twenty-five years.

Mr. MOORE. I have nothing further.

Mr. MORISON. Mr. Hood, I want to ask you the same question that I asked Mr. Corthell. What do you consider the boundaries of Port Los Angeles?

Mr. HOOD. I consider Port Los Angeles to consist of the present Port Los Angeles Wharf, which is officially so known, as I understand it, by the United States Government, and its immediate environment of anchorage, foreshore, and the like of that.

Mr. MORISON. Necessarily including that wharf?

Mr. HOOD. Certainly.

Mr. MORISON. What do you consider the boundaries of San Pedro?

Mr. HOOD. In what sense; the harbor of San Pedro?

Mr. MORISON. In the sense covered by the act of Congress under which we are appointed.

Mr. HOOD. I have never attempted to give an opinion on that question. It had never occurred to me that there was any question. The obvious intent of the discussions in the House and in the Senate has been to discuss the breakwater harbor as proposed by the Southern Pacific Railroad Company, at Port Los Angeles, as stated in Executive Document No. 41, to discuss that breakwater as so stated, and to discuss one or the other of these breakwaters [showing] as proposed by Colonel Mendell and Colonel Craighill, and I did not suppose that it was the intention to tie up a Commission like yourselves to exact position, exact section, exact anything, excepting that substantially the harbor was to be in the one place or the other, as discussed on numerous previous occasions.

The CHAIRMAN. Now, Mr. Corthell, if you want to explain that matter.

Mr. CORTHELL. I do not know as there is any necessity of explaining it, but the facts were just as Mr. Hood stated just now. At the request of the committee I was to make a summary of the argument of both of us, and I tried to do that; but the stenographic notes, much to my surprise and my annoyance, were printed in addition, as you will find them there, and they are not correct at all. But it was printed by the committee and not supervised by anybody, and they may be full of errors.

Mr. MOORE. While you are on the subject, there is another document purported to have been heard before the Committee on Commerce, in the Senate of the United States, which I believe was in April, in which there is a statement of substantially the same sort made by Mr. Corthell.

Mr. CORTHELL. In reference to what?

Mr. MOORE (reading). "Would the waves outside the breakwater have any damaging effect upon the breakwater?" Senator Jones of Nevada asks that question. "Not if the breakwater was properly built, it would withstand those waves, which are not very heavy, even on the Mediterranean, where the waves are 27 feet high; whereas, on this part of the Pacific Ocean the height of the waves is considered to be about 14 feet."

Mr. CORTHELL. I think they are if you get offshore far enough.

The CHAIRMAN. That is hardly in rebuttal, as that evidence has not been before us.

Mr. MOORE. It is probably helping out Mr. Corthell's statement.

Mr. MUIR. No, I think it is helping out Mr. Gibbon.

The CHAIRMAN. Now, Mr. Moore.

Mr. MOORE. Mr. Chairman and gentlemen of the Board. I will try not to occupy your time very long, because, as bearing upon the real merits of the question, I think you will agree that very little need be said. There are a few matters which may be rather regarded in the nature of personal, but not very important, which were mentioned, which I will take up, particularly as calling upon me for some statement, and I will take them up in the order in which they have been already mentioned.

Mr. Corthell calls attention to a statement of mine in regard to Colonel Mendell's opinion, and he quotes also an opinion from Colonel Mendell made in 1882, upon Santa Monica. Now, I think the statement that I made was not to the effect that Colonel Mendell had stated that a breakwater could not be built at Santa Monica, or that if built it would not afford protection to ships, but it was a statement that the opinion of Colonel Mendell was as to the desirability of building a breakwater at San Pedro, and the fact that, after considering the whole question, he had considered it undesirable to afford protection at Santa Monica.

The report from which Mr. Corthell read, and part of which I asked him to read a

little further on, upon Santa Monica, uses the following words: "Upon the foregoing statement of facts, it appears to me that at the present time there is no public necessity requiring the construction of a harbor at Santa Monica." That was in 1882, and is, so far as I know, the only report which bears upon Santa Monica prior to the report of the Board of 1892. However, that is not a very important matter. Even if he had reported wholly in favor of Santa Monica, "it is only the unwise man that never changes his opinion," and he should be judged by the opinion which he last expresses rather than by any other.

As to the quotation from the Board of 1892, I need say nothing, except that I still can not understand the surprise which Mr. Corthell expresses as to the significance or pertinency of that statement, which was not as to the trouble alone from the wind, but the shelter from the sea, which was to the effect that the natural shelter afforded at San Pedro was superior to that which would be afforded by any artificial shelter at Santa Monica; a statement which seems to me very intelligible, and, so far as I can see, very pertinent and very true.

I will not worry the Board with any discussion as to the exact meaning of the word "bight," which I quoted from Mr. Stevenson. Of course, he did not have especially Santa Monica in mind, but any small bay; nor even as to the exact propriety of the phrase which I used of "funnel-shaped." Of course, a funnel is a vessel in which the sides converge toward a point. How proper it is in this case, I will leave it to you. I consider it really very unimportant.

Another matter, with regard to the piling up of waves, which I mentioned incidentally, and simply as suggesting a probable tendency. You will remember also that I stated that the authority for the figures which I gave was the Pacific Coast Pilot. Of course I have made no observations myself, and am not authority for the figures given. They can be found—

The CHAIRMAN. You are referring to tides, not waves?

Mr. MOORE. Tides; yes, sir.

Passing to the next matter which Mr. Corthell mentions, the figures mentioned will be found on pages 43 and 48 of the Pacific Coast Pilot, the fourth edition, in which statement the figures precisely as I gave them will be found, you will note the phraseology, "The spring tides at San Pedro are 4.7 feet, and at Santa Monica 8 feet." Now I have nothing more to say than that, assuming the figures given by Professor Davidson in that book to be correct, the difference as to the probable tendency is a correct one. And while on this subject, I might say in regard to this whole matter of embayment, it is perfectly simple that in a bay of this form [showing] the possible sea room is limited to the shores, which are converging at a point. I think anyone will agree that any location at the farthest point of this bay, or any other bay, will have less sea room, for example, than Point Dume, where there is more than 100 degrees greater sea room in case of any need of sea room.

Mr. Corthell then gives you his reasons for inferring that the Board of 1891 made their plans to provide for sand movement and danger to the harbor from that cause. My statement was that nothing of that kind could be inferred from anything to be found in the record of that Board, and I maintain that that Board should be held responsible only for what that Board said, and they said nothing which I think by any fair inference can be found to sustain that conclusion. They did give their reasons. They state reasons why they made a breakwater as they did, that the two points of it lay toward the greatest exposure, but they do not say that the possible danger of filling up was any part of the reason which moved them to make that plan.

Mr. Corthell's remarks in regard to the varying sea slopes I will say nothing more about than that his proposition, however true it may be as a general conclusion, can only be properly applied where all the conditions are the same; the conditions of exposure and the conditions of protection, the conditions as to the height of the waves. It is possible that the general proposition with those limitations may have some application, but if it should turn out that as applied to any particular case it was at variance with the actual fact, I think we would be compelled to say either that the theory was not applicable to that particular case, or else that that theory was untrue. And that is precisely the condition in which we find ourselves now. All the testimony before your Board, or that can be found anywhere, is that the waves at San Pedro are not higher than they are at Santa Monica, and that therefore any theory which explains why they are higher is either inapplicable or is untrue.

I wish to say a single word further in regard to the volume of that mass of concrete in which Mr. Corthell indicates I was aside from the truth. You will remember that I quoted simply from memory, but I will read from the original lecture by Mr. Thomas Stevenson, which was delivered before the Institution of Civil Engineers on the 16th of April, 1885. You will pardon me if I read two sentences. Mr. Stevenson, by the way, was the engineer of the Wick Breakwater, and certainly had better occasion than anyone else to study it carefully and to draw from it all the lessons which it contains. In speaking of the great height of waves, he goes on to say, "In 1872 a huge monolithic block of concrete, weighing in all 1,350 tons, was

removed bodily out of its position and carried to the lee of the breakwater." I think that is the block that Mr. Cortrell refers to. Extraordinary as this may appear, it was surpassed in 1873, when another concrete mass which had been substituted for the one that was moved was in like manner carried away, though it contained 1,500 cubic yards of cement and rubble, and the weight of which was about 2,600 tons. Taking into consideration the fact that I quoted from memory, I think that my accuracy of memory was very good.

Now, gentlemen, I have nothing further to say. I think that I have established some very good reasons why the situation at Port Los Angeles is not a good location for a harbor of refuge; that it is off the main route of commerce; that it is situated at the bottom of a bay where the sea room is limited by the converging shores, and that it is far inferior to other positions even in that bay. That as a harbor of commerce it can accommodate but a single class of commerce, viz, that of the transfer from ships to cars, or from cars to ships; and from the local situations and surroundings it is very safe to say that it would accommodate the commerce of but a single railroad company. And, on the other hand, San Pedro, from its natural advantages, has been for years actually used as a harbor of refuge; that it affords in the outer bay room for precisely such commerce as is done at Port Los Angeles, and that it affords in addition in the inner harbor an opportunity for a real harbor of commerce in a large sense, and on that view we think the contention of the friends of San Pedro is correct.

Thanking you for your attention, I have nothing further to say.

MR. CORTRELL. I would like to ask you one question, simply to get the evidence right about the tides, as it is a material point, and I will right now file the tide tables which I intended to file, and which are so entirely different that I think there must be a typographical error. I would like to have the matter, if anyone knows, settled now, while the matter is before the Board, for I don't think Mr. Moore would want to make any misstatement; in fact I know he does not. I didn't know but some one here might know, so we could agree before we left.

MR. MOORE. I believe the Board has access to the Pacific Coast Pilot, and I am sure that that will bear out the correctness of my reference. I haven't it to file with them.

THE CHAIRMAN. You are perfectly correct in that reference to the tide. I looked it up myself. A reference to the tide tables shows a different state of facts.

MR. MOORE. As to that, I have no independent testimony. I assume that Professor Davidson in those figures was correct.

THE CHAIRMAN. The probabilities are that the tide tables are correct and it is an error in the Pacific Coast Pilot, but your quotation of it is perfectly correct.

MR. MOORE. That may be, but, if true, it was an interesting fact and suggested a probable tendency, which was all that we claimed for it.

MR. MORGAN. Mr. Moore, you stated that the proposed location for a breakwater, substantially as laid down, was an inferior one to other points in Santa Monica Harbor. Will you be kind enough to state where the superior point is?

MR. MOORE. As a harbor of refuge, if you please?

MR. MORGAN. Yes, sir, as a harbor of refuge, and for the purpose of carrying into effect the act of Congress.

MR. MOORE. I beg your pardon. If I was so understood, I did not have that in mind. I was then speaking simply of a harbor of refuge. I had reference to the same matter that I mentioned before, that from all the testimony, as a harbor of refuge solely, Point Dume was a very much superior location; so much superior that, as I stated, I think except for the building of the Southern Pacific Wharf this location mentioned would never have been thought of.

MR. MORGAN. Then you are dividing the propositions of the act of Congress? You would not establish a harbor for commerce at that point, would you?

MR. MOORE. I think not. No, sir.

MR. MORGAN. Then you divided the purpose of the act of Congress in your statement, and referred simply to a harbor of refuge?

MR. MOORE. For the purpose of clearness, I thought the requirements of a harbor of refuge could best be discussed when considered by themselves. That was my meaning.

MR. MORGAN. I would like to have you say something more in respect to what has been termed a "bight," or an "embayment." That is an important point, and I would like to understand it as thoroughly as possible. Take a focal point—say of some point on that breakwater—and discuss it as an embayment.

MR. MOORE. What I mean is this: Suppose a ship needing a harbor of refuge is seeking refuge behind this breakwater; that the weather is thick and heavy, and they undertake to make, we will say, this west entrance. If for any reason or failure to properly manage their sails, or a miscalculation of the exact point of entrance, they have no room in which to recover themselves, they are at once drifted upon the shore or upon the sides of the pier. And similarly, although not to as great an

extent as at the west end, at the east end. Failing to make the harbor, they are impinged against the wharf it is proposed to build there, or they are drifted near into shoal water. The space is less than a mile, I should say, to the shore on which the vessel would be beached; whereas, if it were on a point with room each way to manage themselves, and the comparative scope of the horizon which was occupied by land and water, the scope of the water would be much greater, so that there would be a larger space in which to recover themselves. These conditions exist to some extent at San Pedro, with the further condition that the contours and the area of deep water are very extensive. The 6-fathom contour and the 5-fathom contour are but very little way outside of the end of the Long Beach Pier, which, I will say, I presume is 5 or 6 miles outside of the entrance. Of course, in this other direction there is unlimited room.

Mr. MORGAN. Will you point out where that rocky point is, about the bell buoy on that map, as near as you may be able?

Mr. MOORE. The bell buoy is about there [showing position].

Mr. MORGAN. Would that be more of a bight in Santa Monica Bay than it would be to get into that harbor opening to the southeast?

Mr. MOORE. You are referring to the bell buoy?

Mr. MORGAN. Yes, sir; to the rocks there at the bell buoy and the shoal water.

Mr. MOORE. The bell buoy rock is a source of danger, of course. However, it is a danger which there is ample warning against, and it is a very complete warning, from the fact of its having a bell buoy on it.

Mr. MORGAN. The bell buoy there at that rocky point would be to the leeward of the point of your breakwater. Do you think there would be a necessity for a bell buoy at a breakwater like that? Such a shore as that?

Mr. MOORE. As to that I can not say. There is no rock there, but whether there would be a necessity for a bell buoy to warn them off shore, really I could not say.

Mr. MORGAN. Now, I will leave that branch of the subject. In regard to sailing out of Santa Monica Bay with sailing vessels. The arc of that bay, we will say, as I understand from what I have read here, is something over 100 degrees from that focal point. Now, would there be any difficulty in sailing a ship out or a sailing vessel out of that bay in a storm with 100 degrees or more to work on?

Mr. MOORE. Well, I would not like to give evidence as a navigator.

Mr. MORGAN. I didn't know but you could answer that, or what your experience may have been.

Mr. MOORE. As to how easy or how difficult it would be I really am not qualified to say; but certainly more difficult than if the shores were farther away.

Mr. MORGAN. It would be an important consideration, would it not, whether you could sail out properly out of this bay (Santa Monica)?

Mr. MOORE. Certainly. No question about that.

Mr. MORGAN. I didn't know whether from your experience you would be able to answer that.

Mr. MOORE. I do not mean to say that vessels could not sail out. As to how difficult it would be, I am not really capable of saying.

Mr. MORGAN. These questions are so important it leads me to inquire about them.

Mr. MOORE. Yes, sir.

The CHAIRMAN. Did I understand you to say you would put your harbor of refuge under Point Dume?

Mr. MOORE. If I were looking simply for a harbor of refuge in Santa Monica Bay. The CHAIRMAN. Wouldn't you find deep water there that would prevent your making a harbor of refuge?

Mr. MOORE. Well, I believe there has not been a minute survey there, and I don't know what the conditions are.

The CHAIRMAN. You don't know what the depth of water is there? I should imagine that off that point you would find deep water.

Mr. MOORE. I think there is no chart which answers that very fully, and I would not make any statement about it.

Mr. CORTHELL. Have you examined the Coast Survey chart for this proposed harbor at Point Dume? It is given right there.

Mr. MOORE. I have not examined it, nor have I considered that anyone would seriously place it there, unless he were limited to Santa Monica Bay. I did not suppose it was a practical question, because, as I understand it, this Board has no option in the matter. It must be at Port Los Angeles, or it must be at San Pedro. The field is not open, except to that extent.

The CHAIRMAN. I only asked the question because you stated that in selecting a harbor of refuge in Santa Monica Bay you would put it at Point Dume, and it occurred to me you would probably find pretty deep water there, although I have not looked the chart up.

Mr. MOORE. It not being a practical question, I would say that I have not looked at it with great care. I have studied the natural advantages at a good deal of length,

upon which the Coast Pilot dwells, and to which one of our witnesses alluded in the most casual way.

Mr. HAWGOOD then addressed the Board as follows:

Mr. Chairman and gentlemen of the Board, I have but one or two remarks to make, and I fully agree with Mr. Hood that any reviewing of technical evidence here would be superfluous, but in regard to the flat bottom or flat slope of a sea bed, I do not find that the opinion of Mr. Corthell is unanimously accepted. I will quote the opinion of the engineer in chief of the harbor works at Leghorn. It can be found in volume 118 of the Proceedings of the Institution of Civil Engineers, at page 113, and it says: "The greater the force of the waves the flatter the slope of the sea bed." I have no further remarks to make on this head except to say it shows that "doctors differ."

In the matter of the drift of the sand, Mr. Corthell lays it down as a cardinal principle that they (speaking of the currents) deposit the moving sands on the side of the works from which the current comes. I don't think that anyone will deny this, but I simply desire to draw attention to the fact that in the testimony the sand is on the west side of the projection at Santa Monica and that the bar at the mouth of the inner harbor is on the westward. The other evidence as to drift you have before you. I do not believe I have any more remarks to make.

Mr. MORGAN. I made some inquiry about the drainage of this county and you said you would file some statistics in regard to that.

Mr. HAWGOOD. I am getting it together for you and will file it as soon as I get it together, and submit a copy to Mr. Hood.

Mr. GIBBON. I have in my hand a volume which Mr. Hood discovered on "Irrigation in California," which has some matters in it about the general course of streams, watersheds, etc., which may be of interest to the Commission, and it will be submitted by both sides to the Board, with the understanding that if there is anything detailed in it which proves to be incorrect, it may be corrected before the Board.

Mr. Weldt desires a word said for him in explanation of a matter which I can say for him as well, which is that before the law was passed requiring a certified pilot at San Pedro, he acted for a number of years as pilot there without a certificate. So he does not limit his period of service.

There is one other matter. The analysis by Mr. Hood of the petitions which were filed; I should like to ask, in the absence of the Free Harbor League, for the right to file one of the petitions, because I am pretty sure there are a good many names upon that petition in our favor. I will say in conclusion, in regard to Mr. Hood's expression of contempt for petitions, that I will refer the Board to the report of the Board of Engineers for 1892, as well as to the course of the discussion in the last Congress, where they will find there was a time when our friends did not view petitions in such a haughty way as they do now, but it might be cruel for me to remind my friend, Mr. Hood, of the fable of a very wise animal and some grapes.

The CHAIRMAN. Do you want to ask Mr. Gibbon a question?

Mr. MUIR. I don't think he answered the question in regard to Mr. Weldt operating ships.

Mr. GIBBON. Mr. Weldt can answer those.

Mr. WELDT. I will answer the questions.

Mr. MUIR. I understand that while clerking in a store in San Pedro, prior to 1886, you were going out in what we call a "bumboat" to get orders from ships?

Mr. WELDT. I never was a clerk for a store in San Pedro in my life.

Mr. MUIR. Did you ever follow the sea prior to the appointment of pilot?

Mr. WELDT. Yes, sir.

Mr. MUIR. In what way?

Mr. WELDT. Before the mast and as an officer.

Mr. MUIR. On what ships?

Mr. WELDT. I was on the American ship *Young America*.

Mr. MUIR. In what year?

Mr. WELDT. That was in 1869 or 1870.

Mr. HOOD. I wish to say in explanation and for Mr. Gibbon's information that I do not know that the contempt I expressed in regard to petitions was shared by the remainder of my side, but it was my personal contempt. Also, before the Board of 1892, I did not have my own way, or there would not have been any petition presented by our side.

Mr. MOORE. We would like to ask Captain Smith in regard to the statements made as to his not being master of a ship and in reference to a telegram from Captain Whitelaw stating that he was not master of a vessel.

The CHAIRMAN. That he had no recollection of his being master?

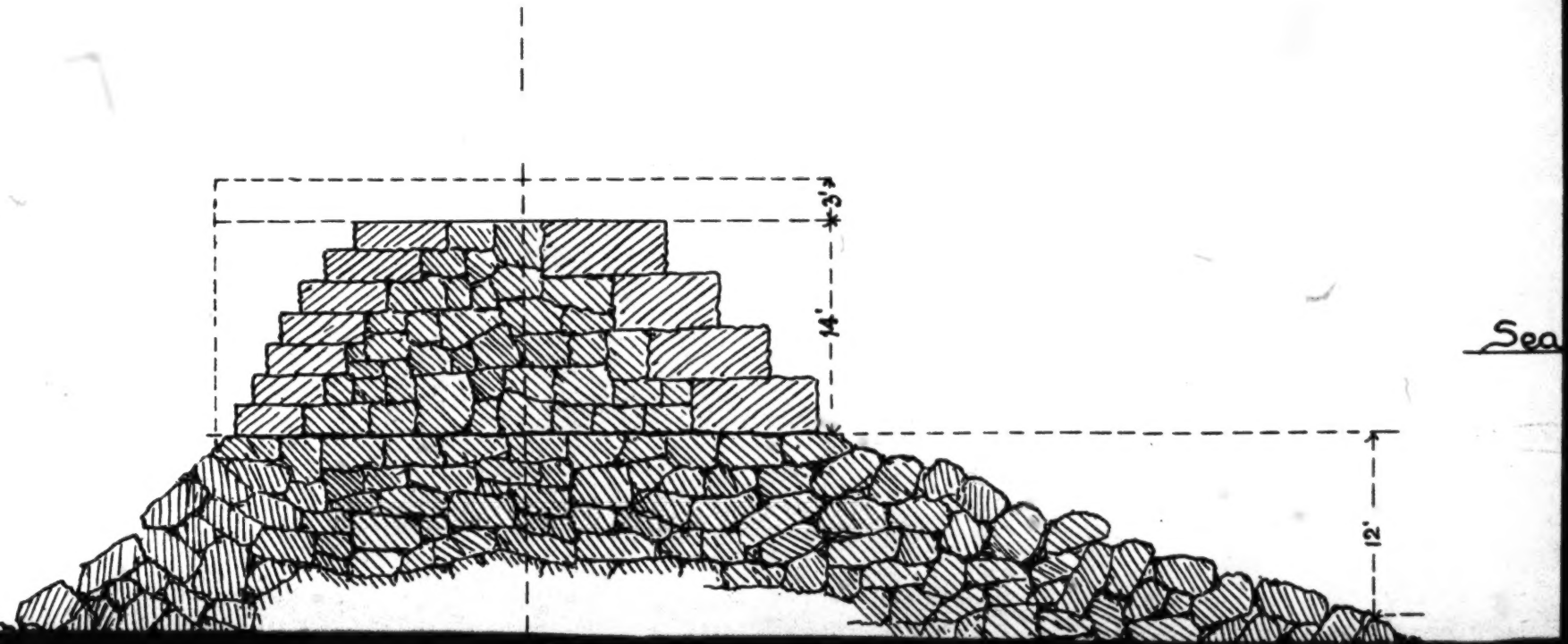
Mr. SMITH. No; not at that time. The captain was sick and I took his place, and I had master's papers and was pilot for San Pedro for years before that. I want to clear my own reputation, and I say it, and if he (Mr. Muir) wants any better proof he can go to his own books, right down in the port when I was master of that vessel,

Cross Section and Plan of Breakwater
to accompany
Report of Board for Locating a Deep Water Harbor in Southern California.

Scale: $\frac{1}{120}$ or 10 feet = 1 inch.

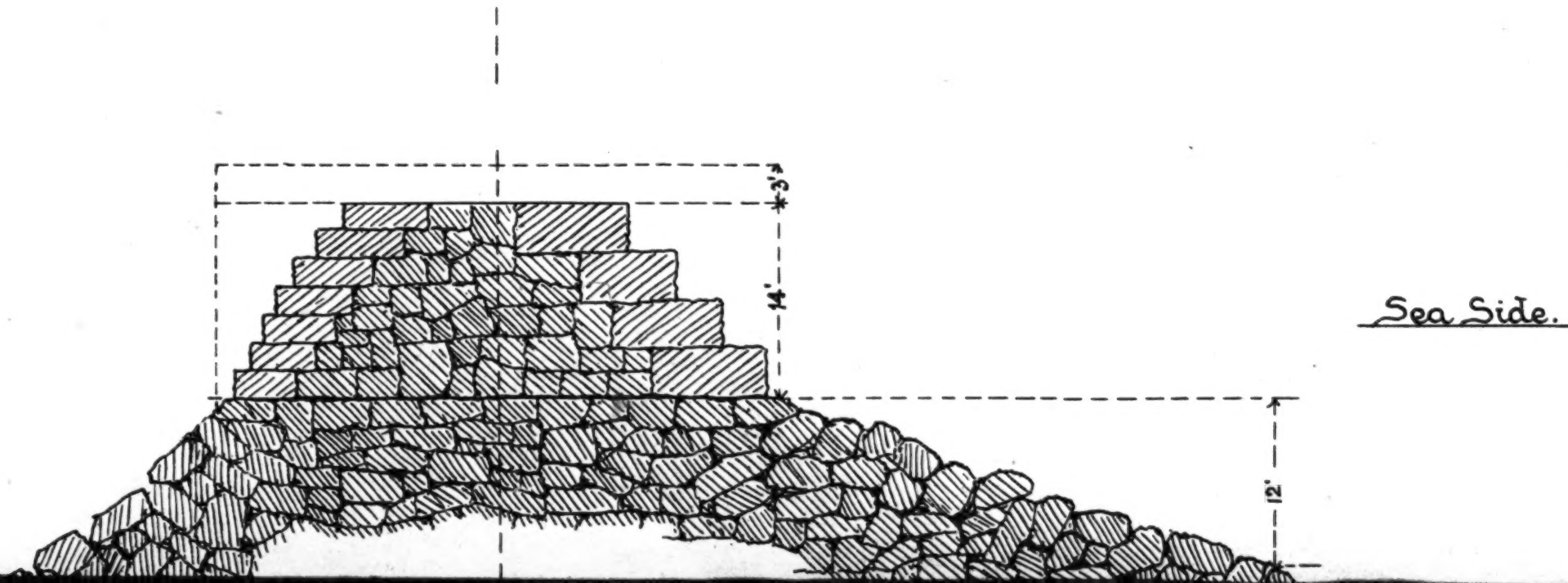
J. E. Waller
Chairman

Harbor Side.

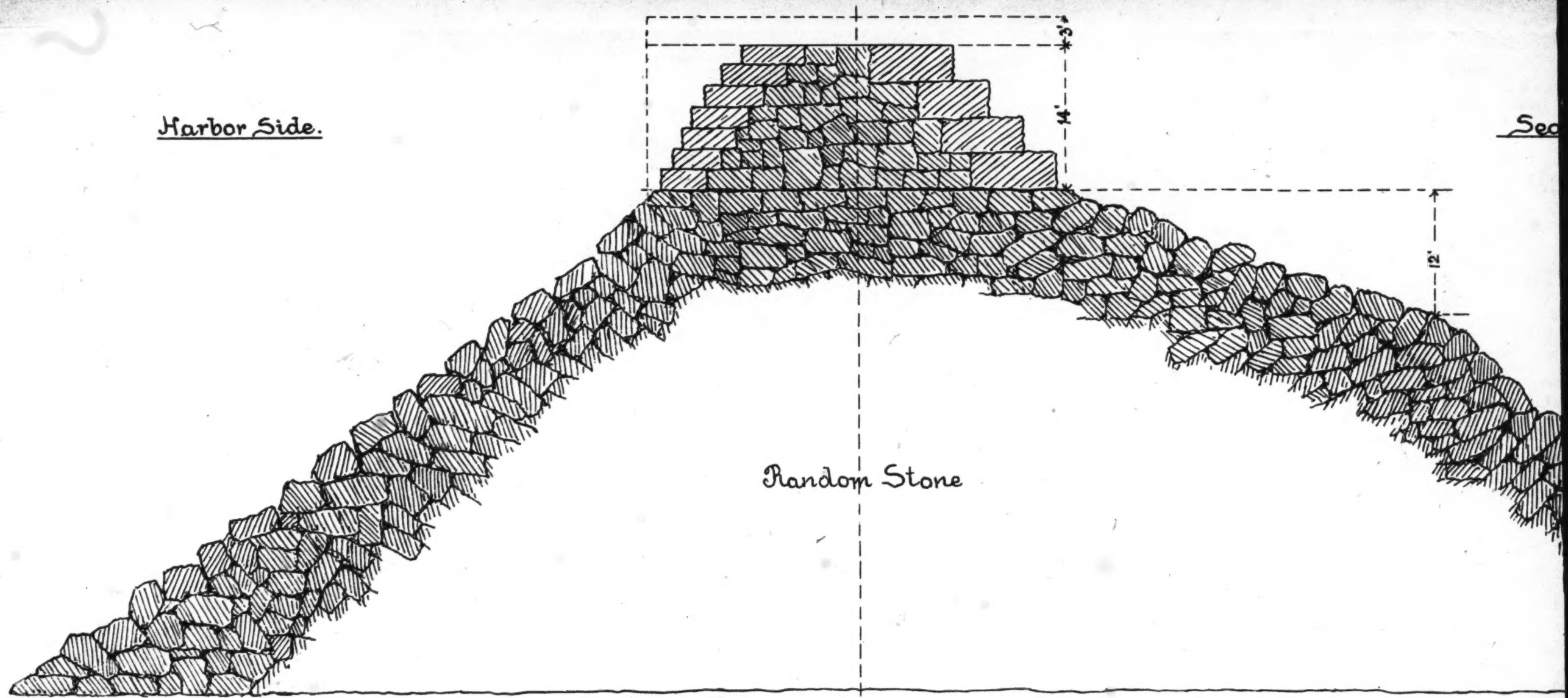


Cross Section and Plan of Breakwater
to accompany
Report of Board for Locating a Deep Water Harbor in Southern California.

Scale: $\frac{1}{120}$ or 10 feet = 1 inch.

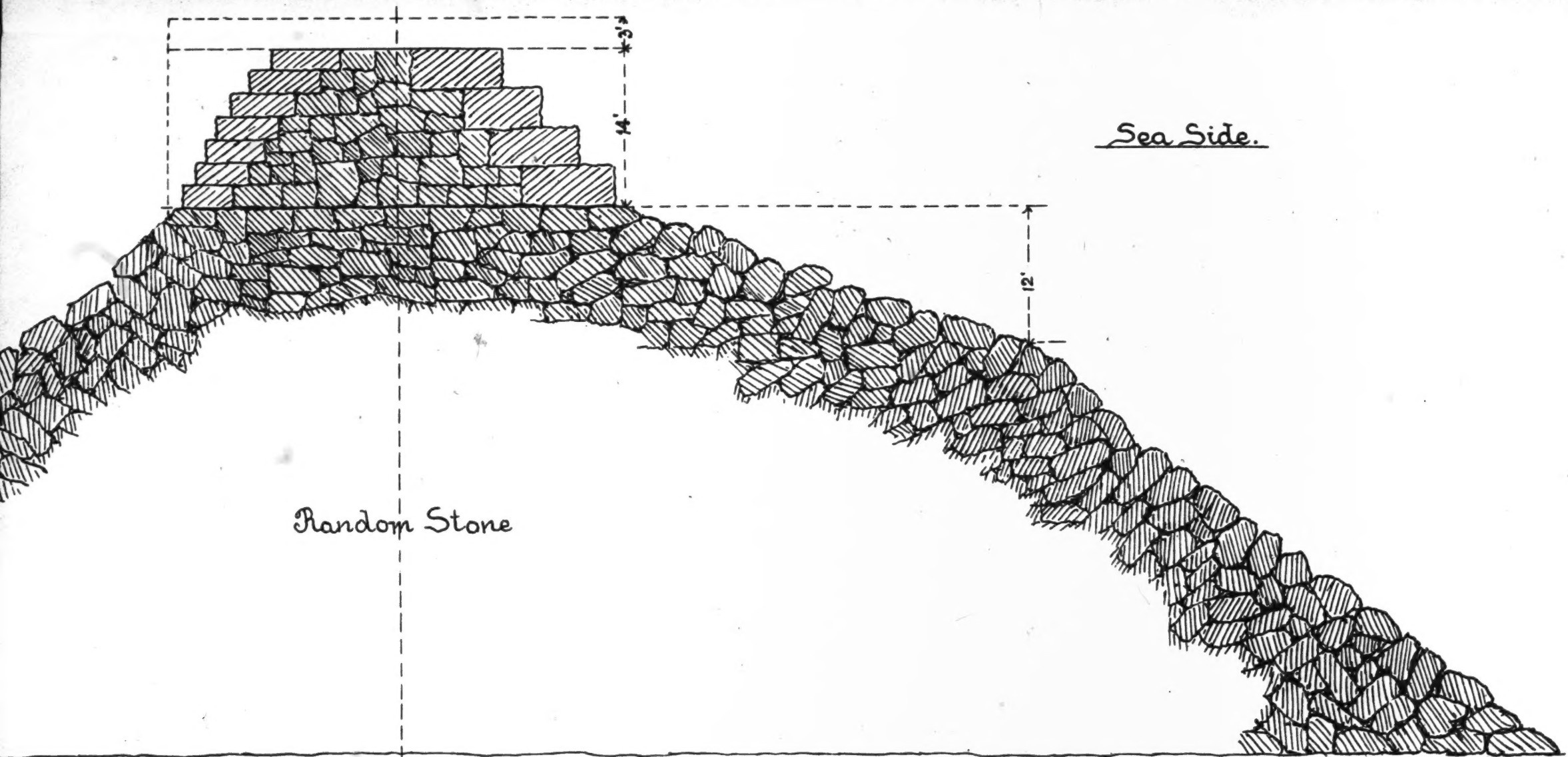


Harbor Side.



Random Stone

Section.



Random Stone

Sea Side.

Section.

A technical cross-section drawing. A central vertical dashed line represents the centerline. At the bottom, a rectangular 'Concrete Block' foundation is shown, with a horizontal dimension line indicating a width of 20' on each side of the centerline. Above the foundation, the ground surface is shown with a 'Natural Slope about 1:1.3'. The slope is represented by solid lines extending upwards and outwards from the top corners of the foundation. A vertical solid line on the far left and a vertical solid line on the far right define the boundaries of the drawing area.

Natural Slope about 1:1.3

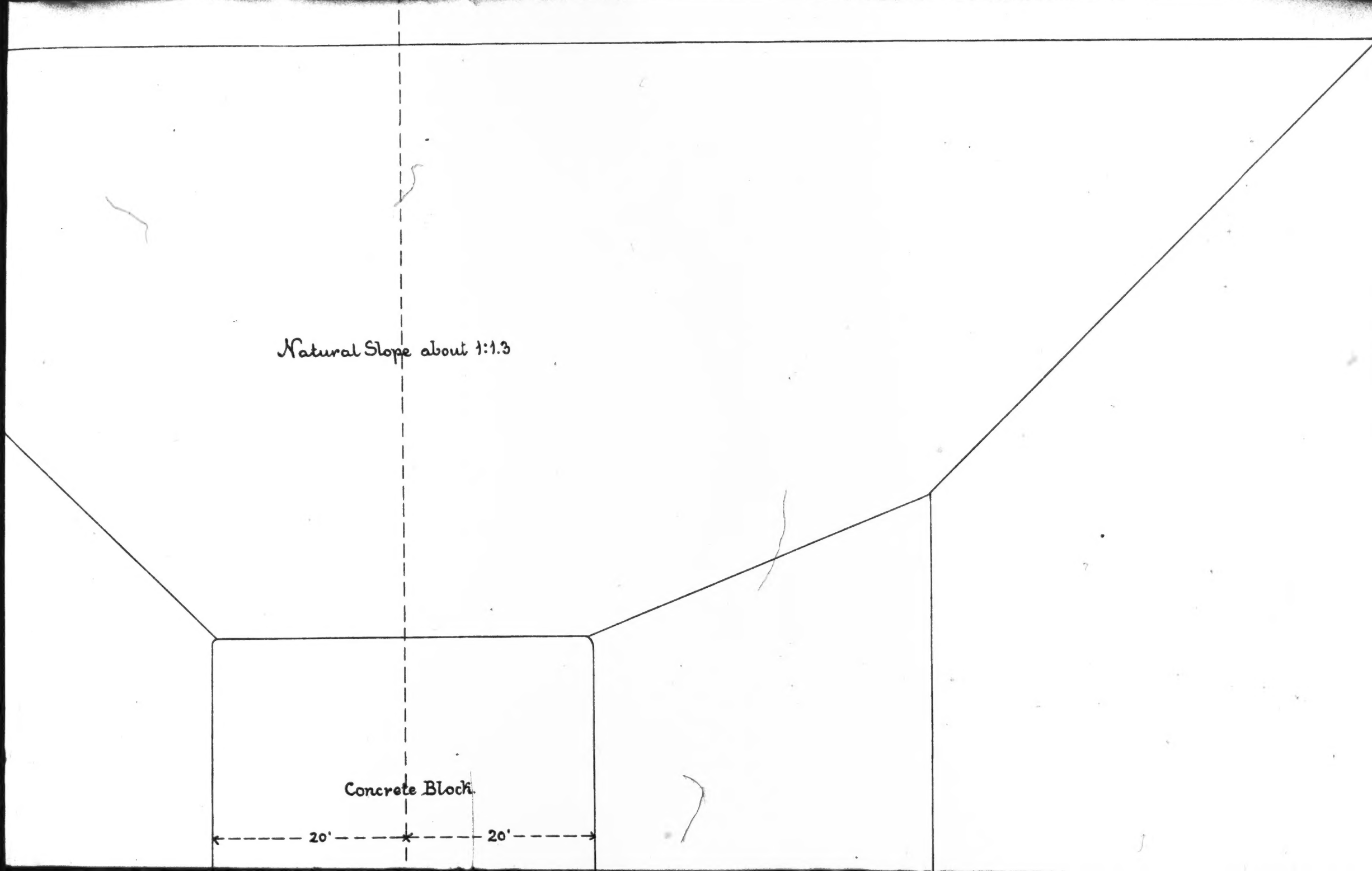
Concrete Block.

← 20' — * — 20' →

Natural Slope about 1:1.3

Concrete Block.

← 20' → 20' →



Natural Slope about 1:1.3

Concrete Block

20' 20'

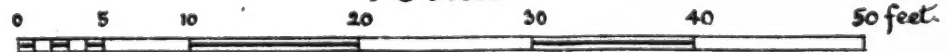
11' 9'

10' 19'

55'

Plan of End.

Scale.



Concrete Block.

← 20' * 20' →

← 11' * 9' →

← 19' * 19' →

← 55' →

Natural Slope about 1:1.3.

an of End.

Scale.

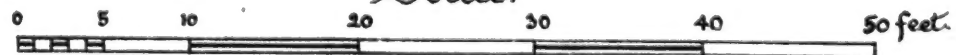
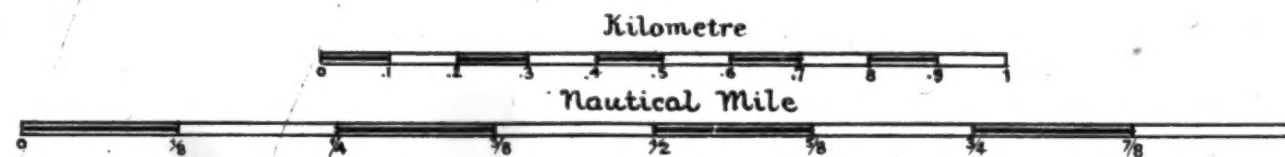
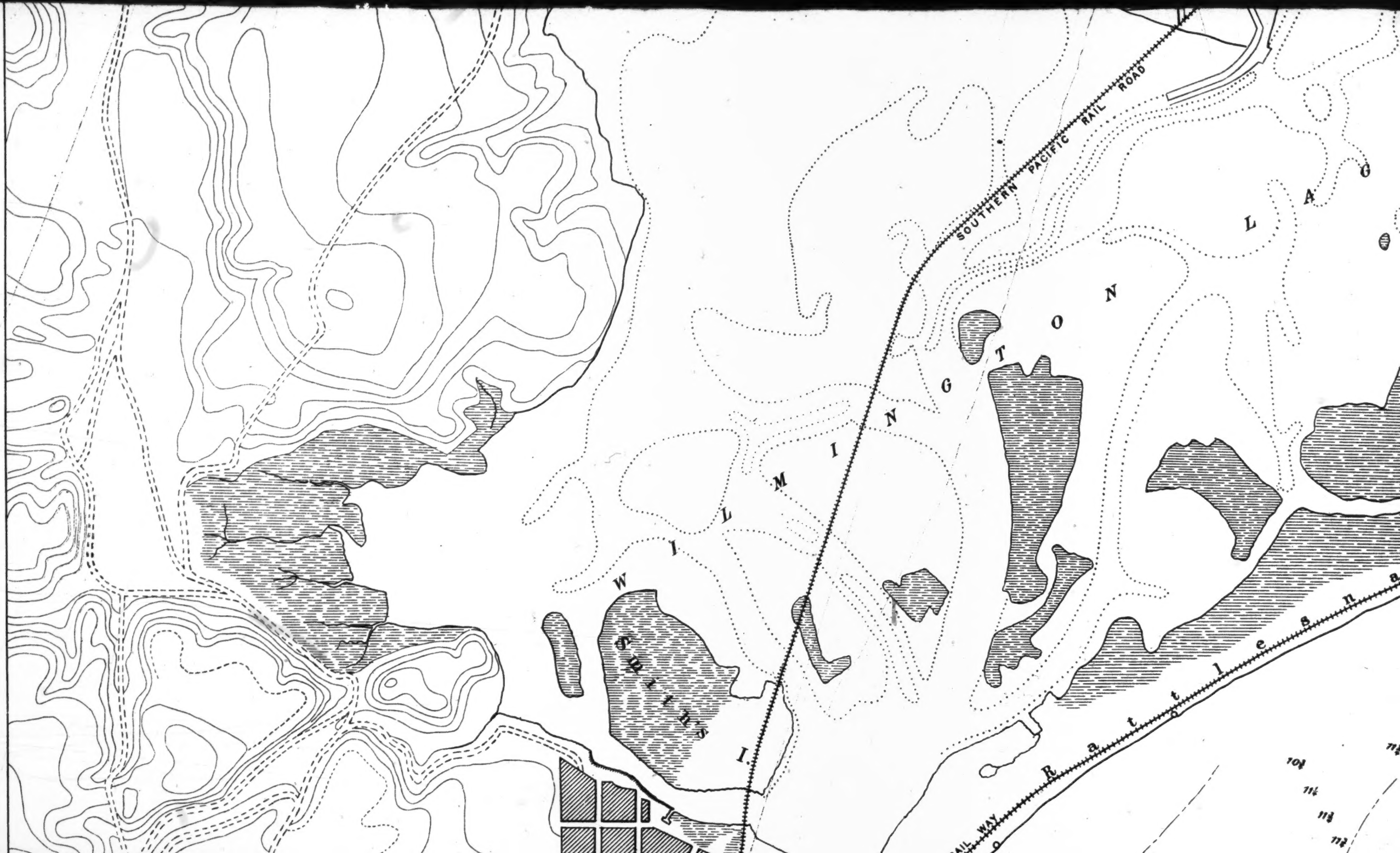
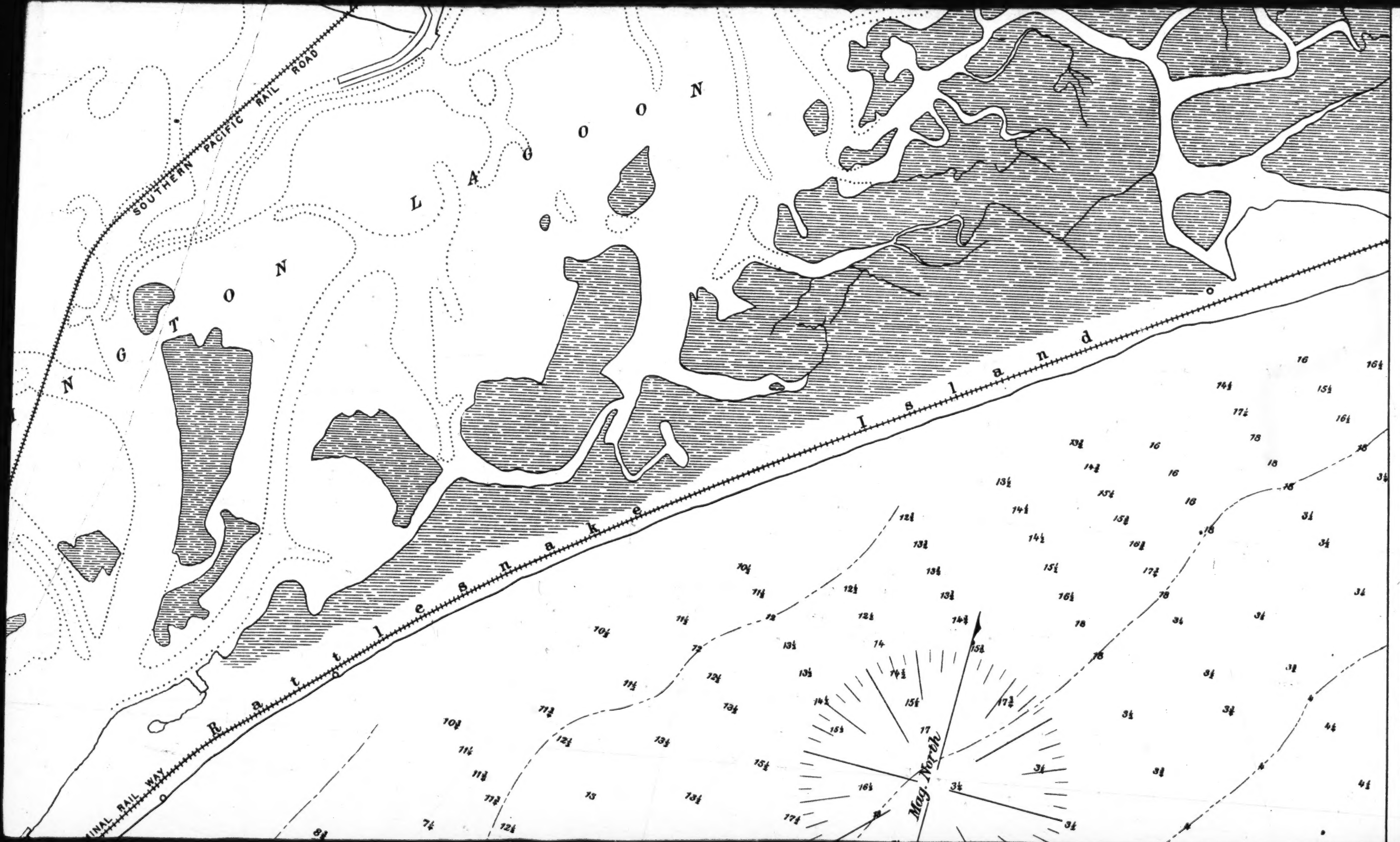


Chart of San Pedro Bay and Harbor
showing location of Breakwater, to
accompany Report of Board for
Locating a Deep Water Harbor in Southern California.

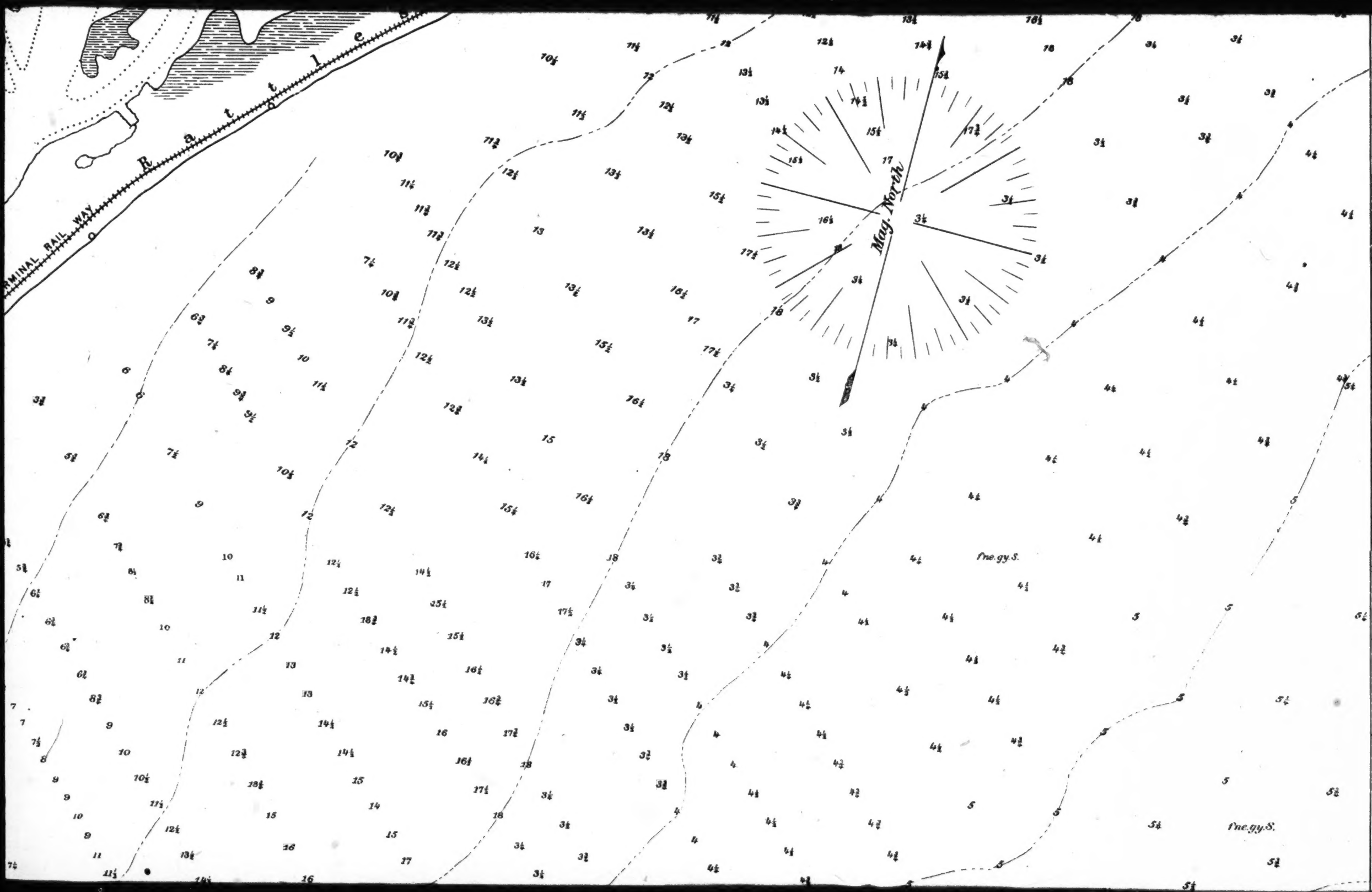




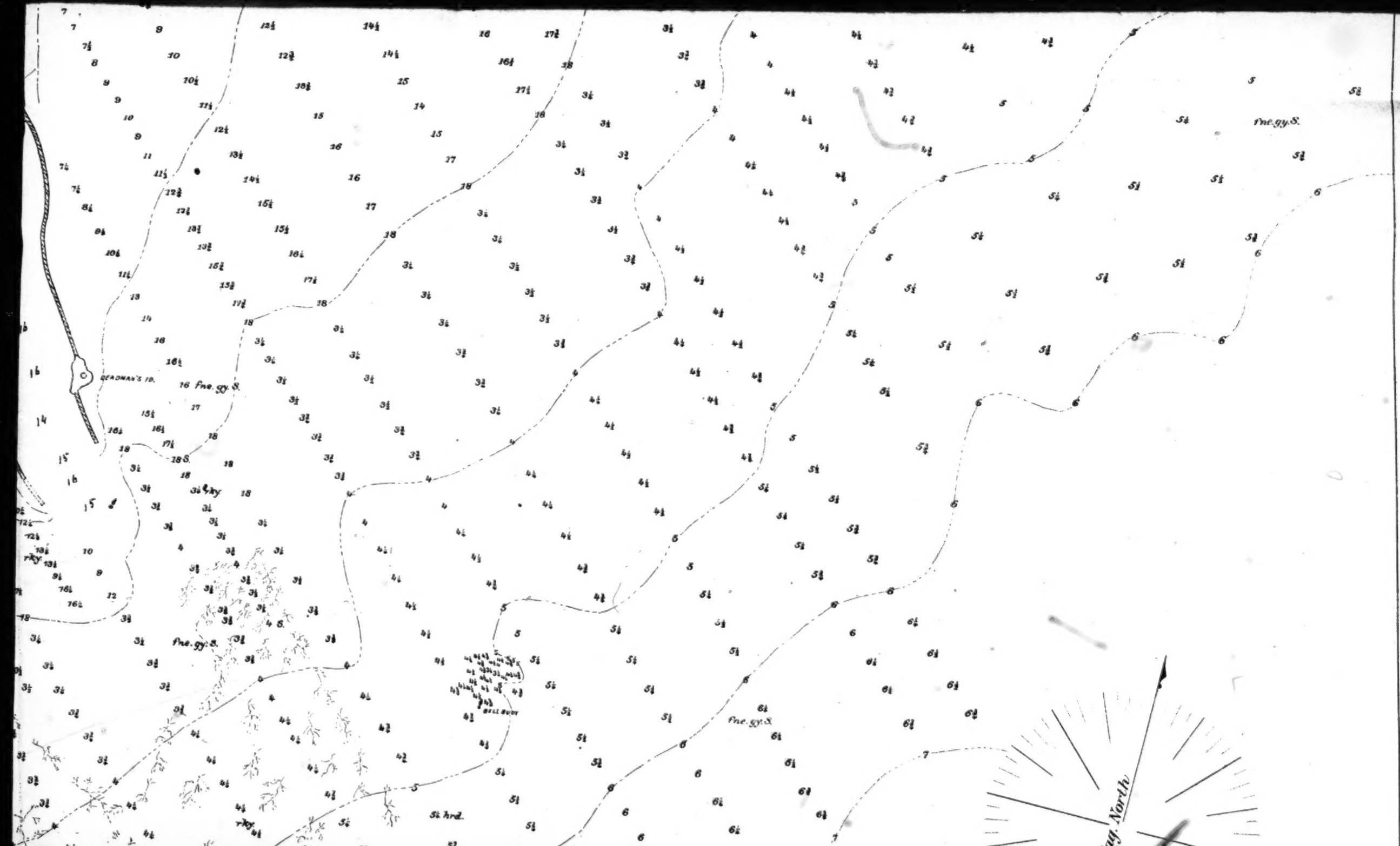


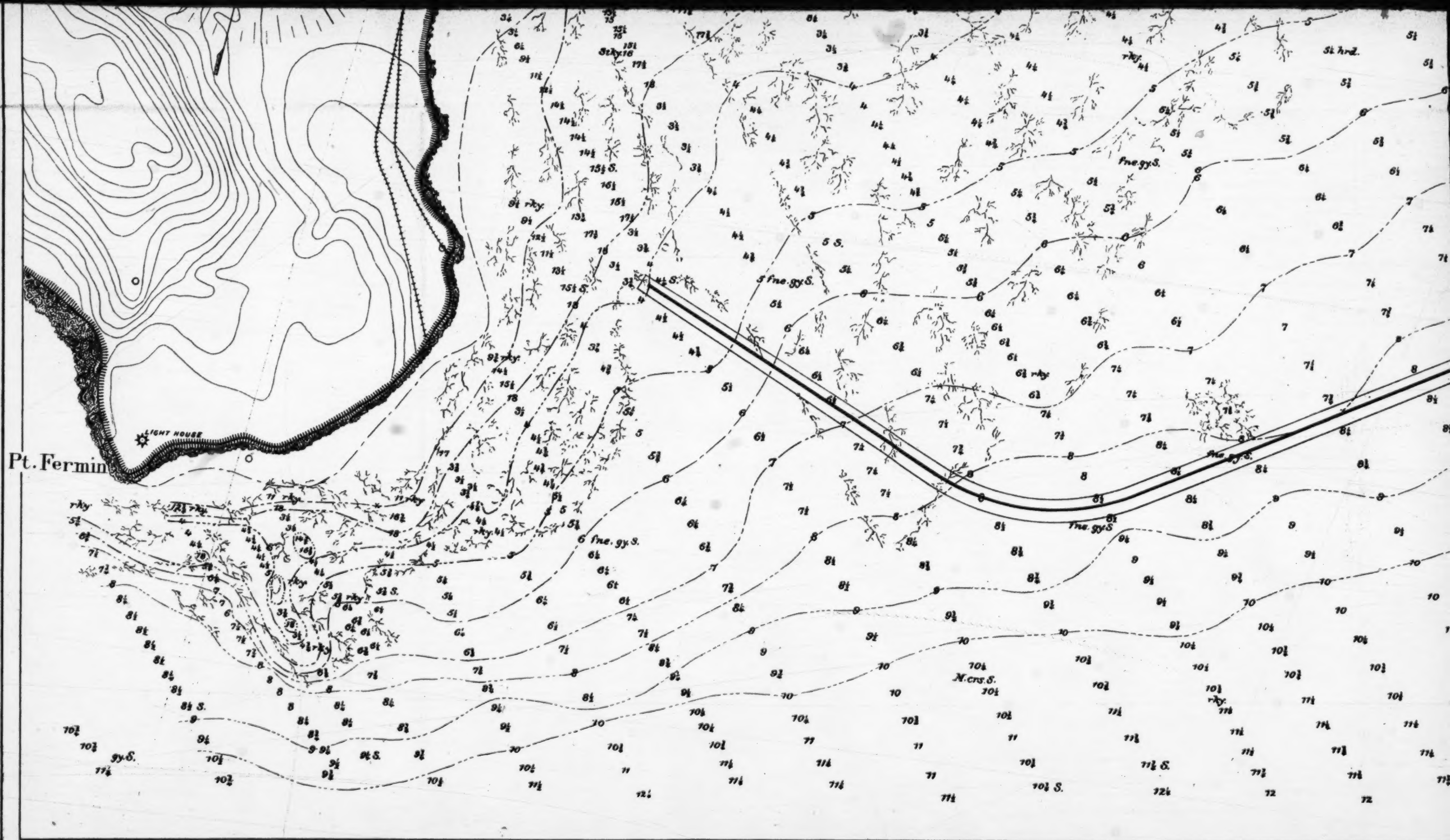








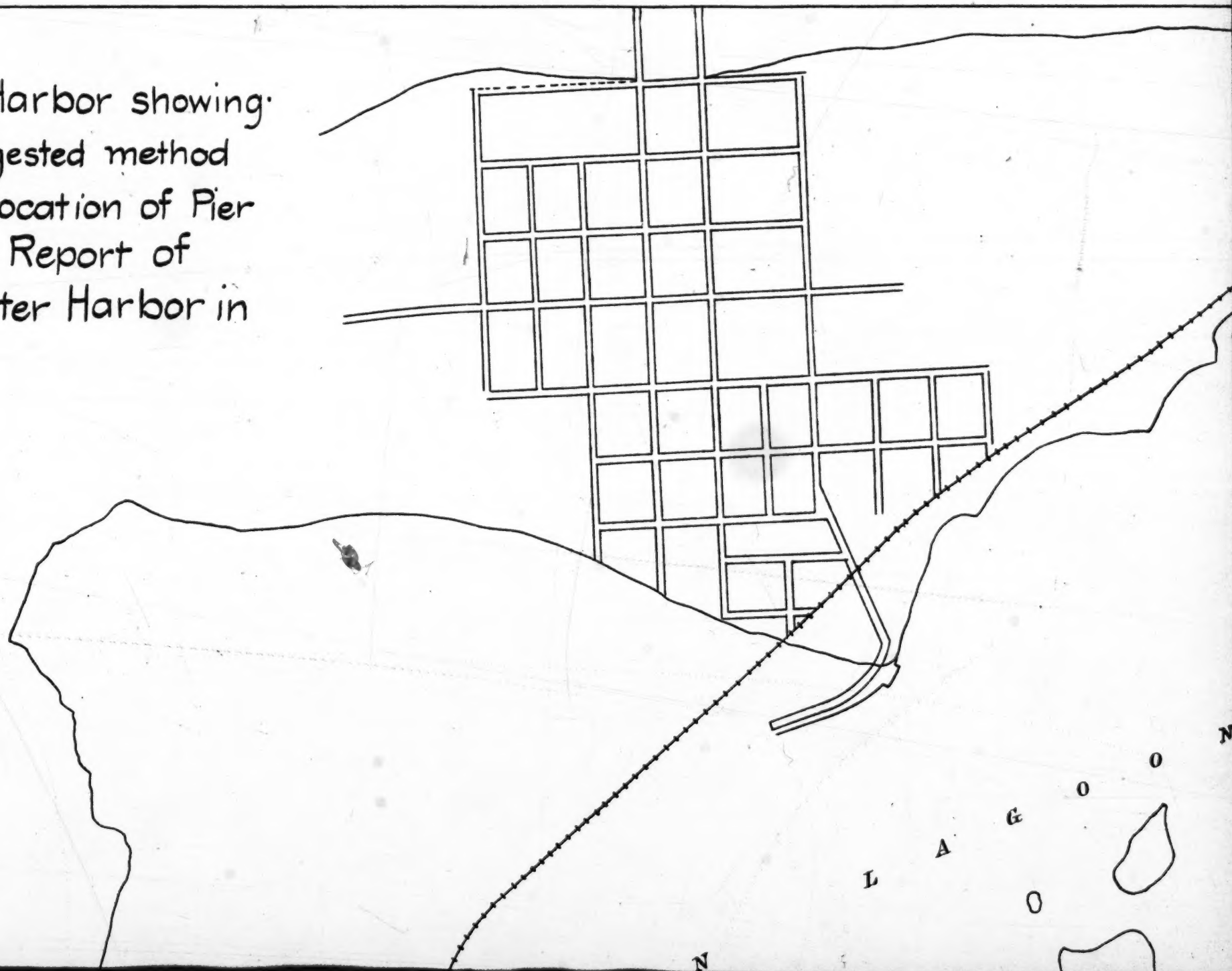




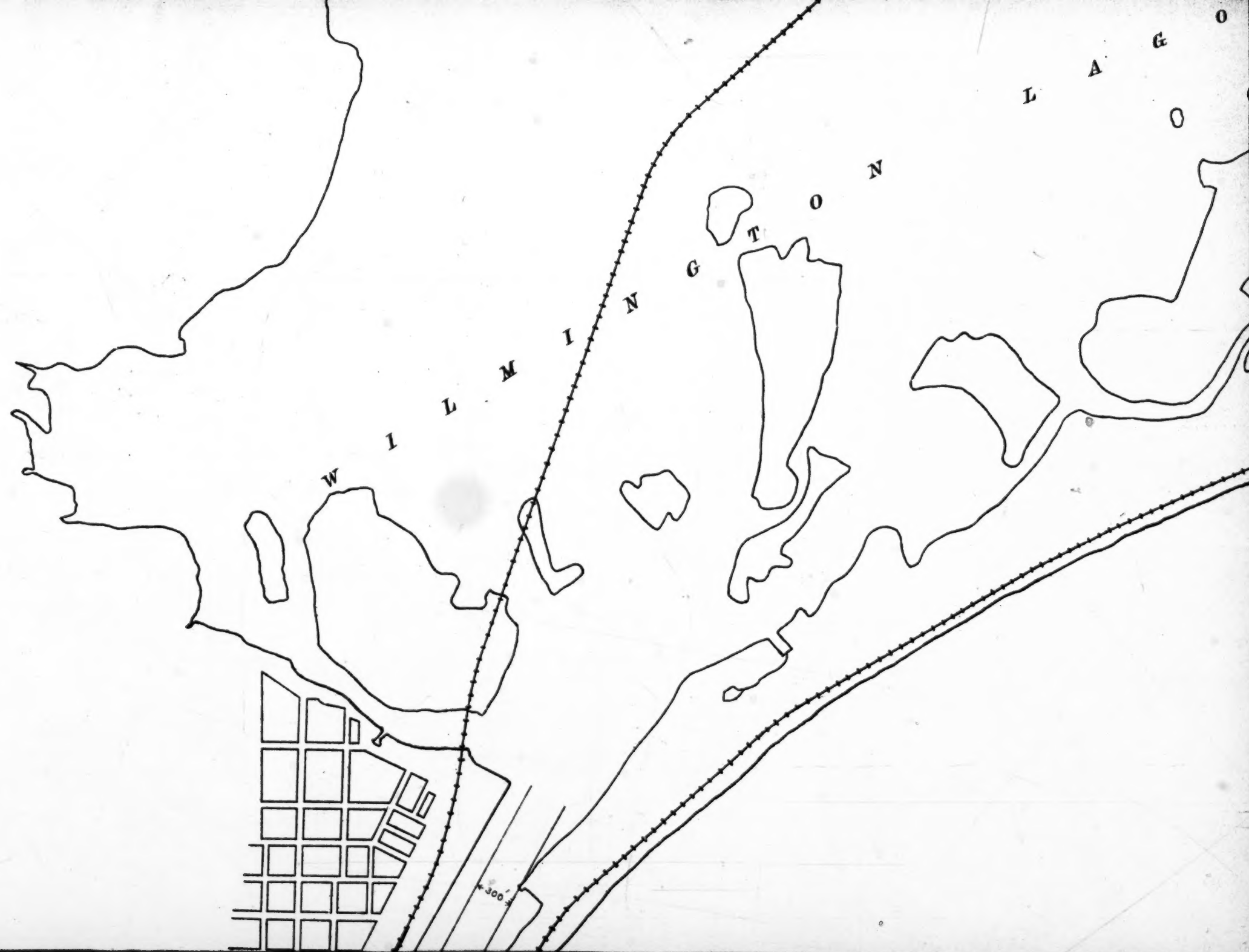
Map of San Pedro Bay and Harbor showing
location of Breakwater and suggested method
of utilizing Inner Harbor and location of Pier
in Outer Harbor, to accompany Report of
Board for Locating a Deep Water Harbor in
Southern California.

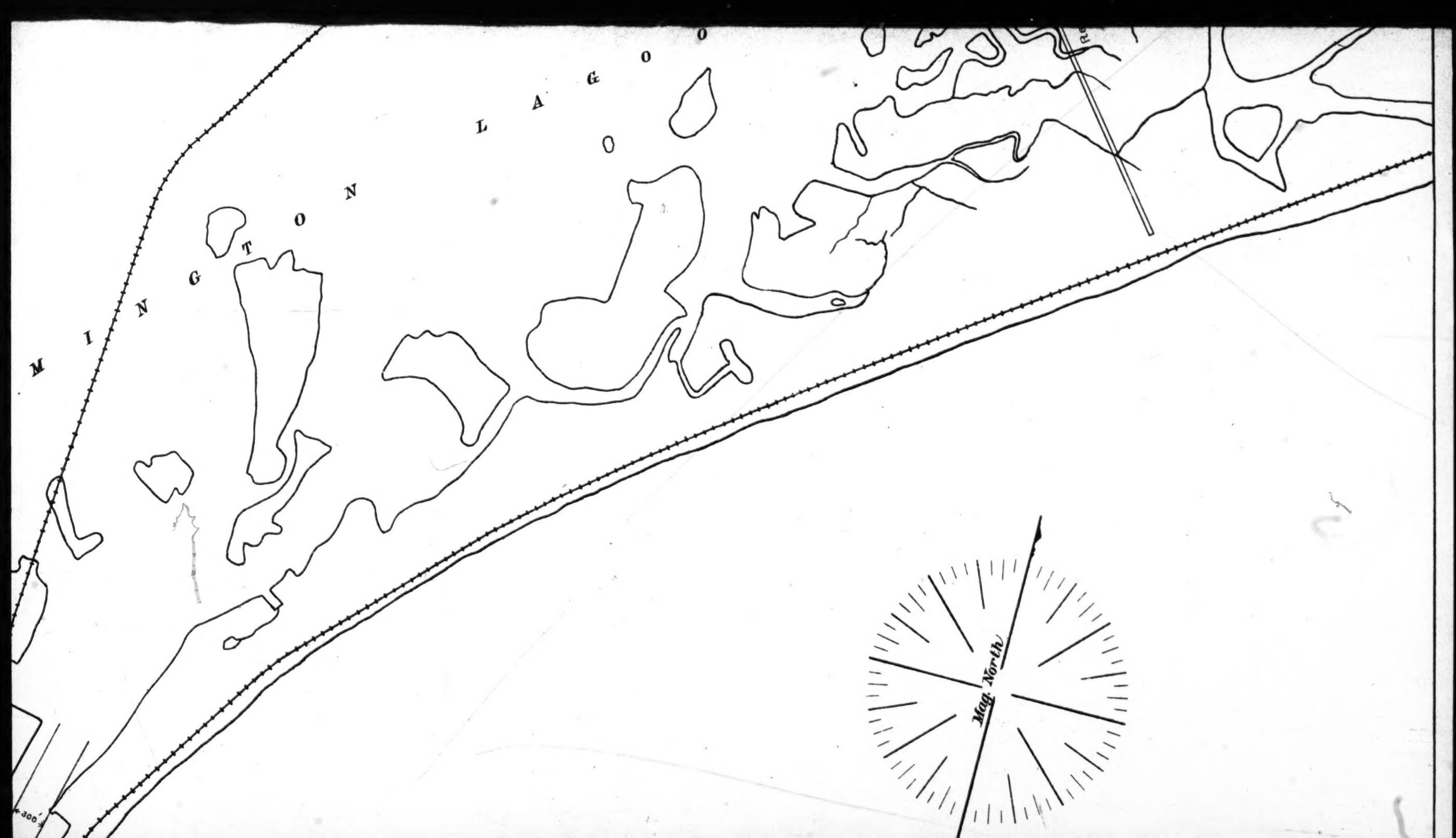
Scale, $\frac{1}{10,000}$.

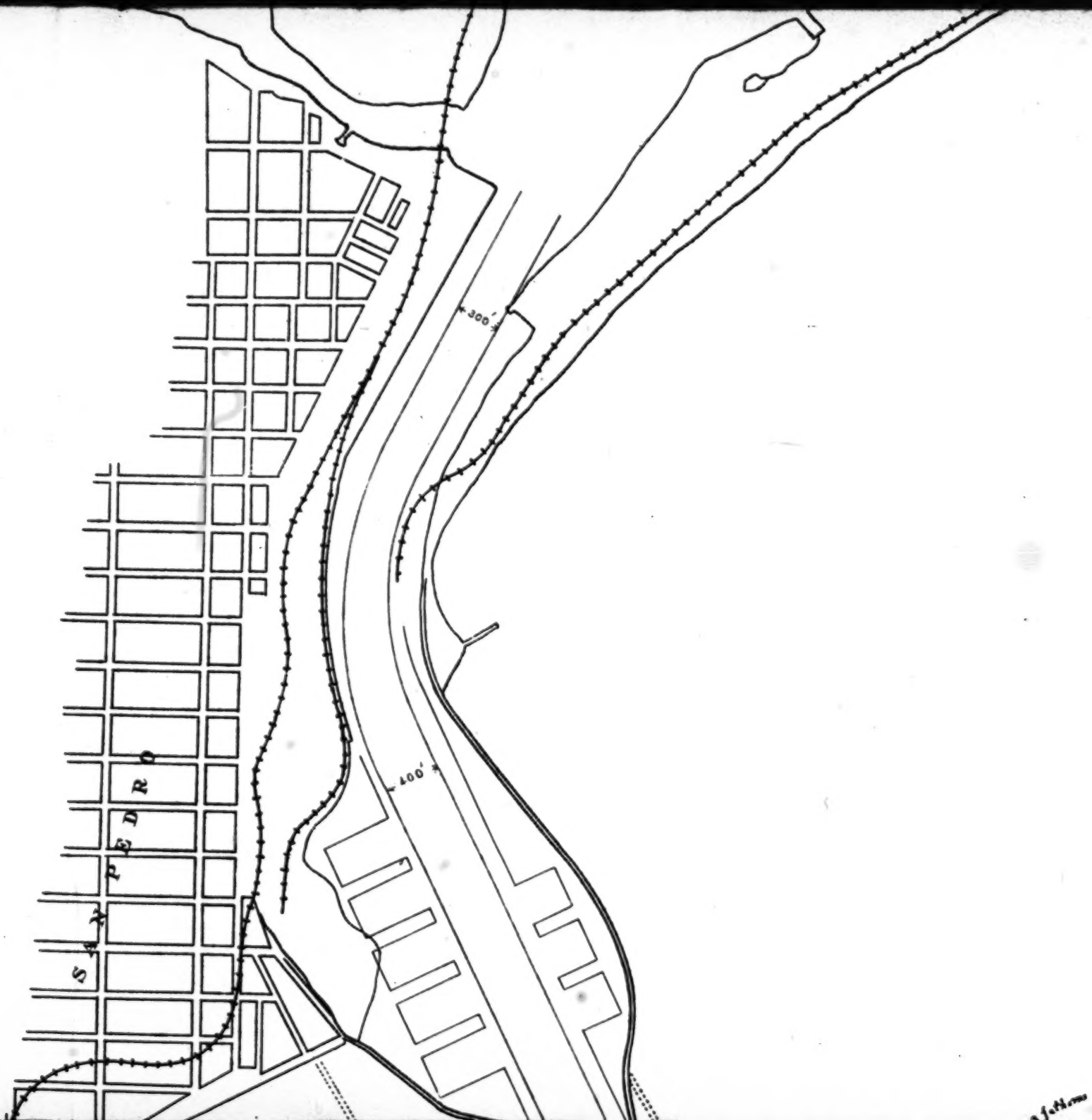
J. E. Macken
Chairman

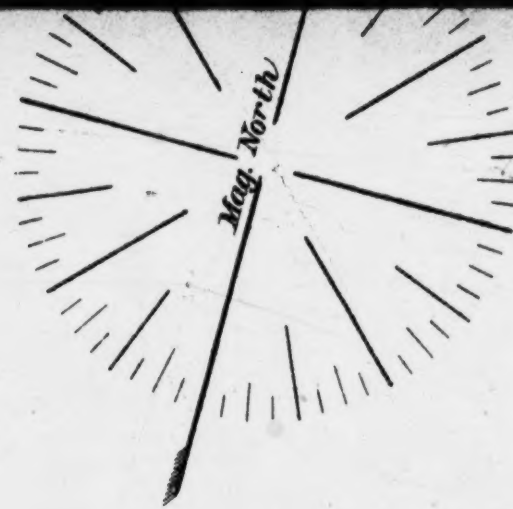










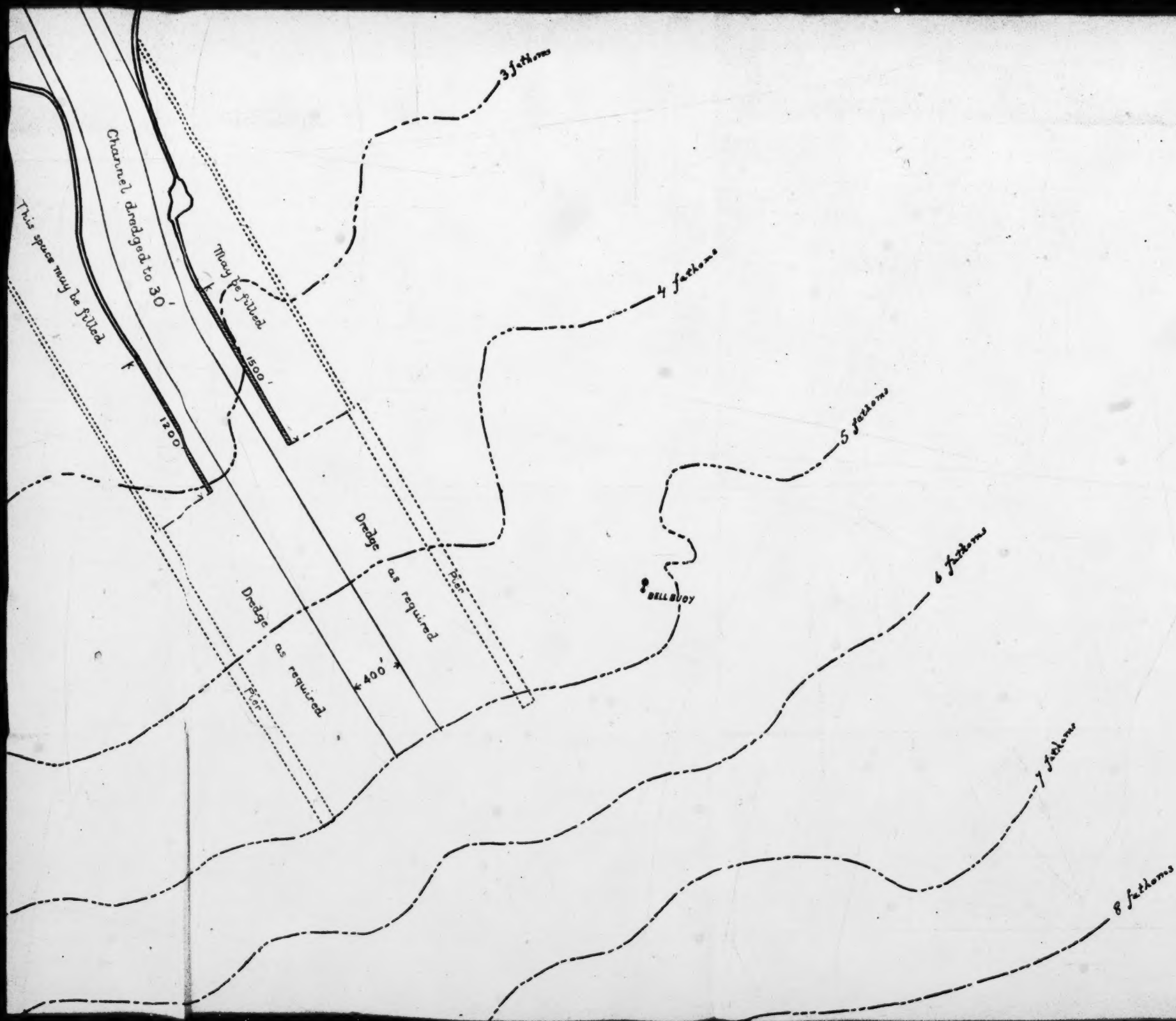


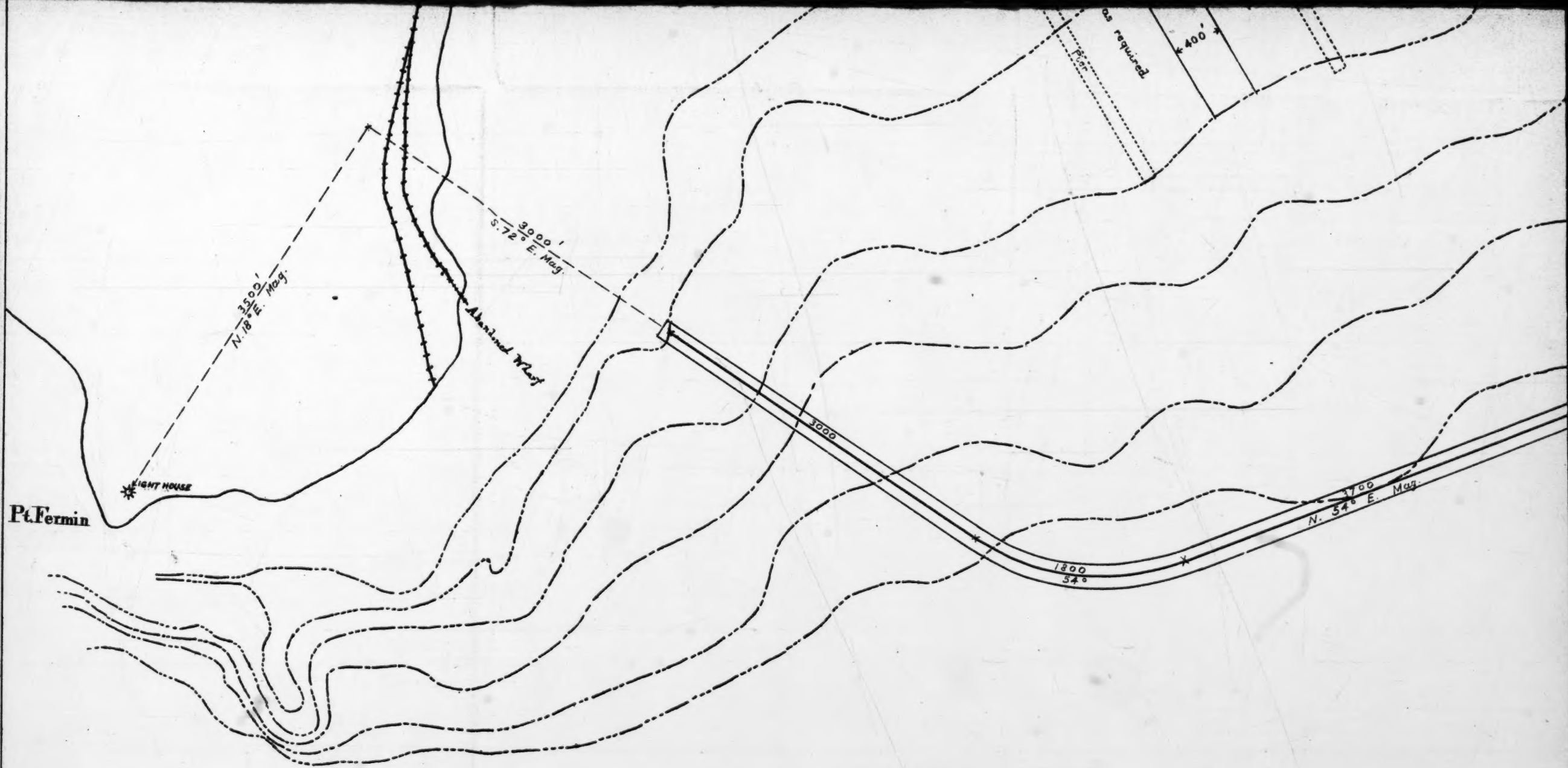
35 ft. 4 in.

3500'
N. 18° E. Mag.

3000'
S. 72° E. Mag.







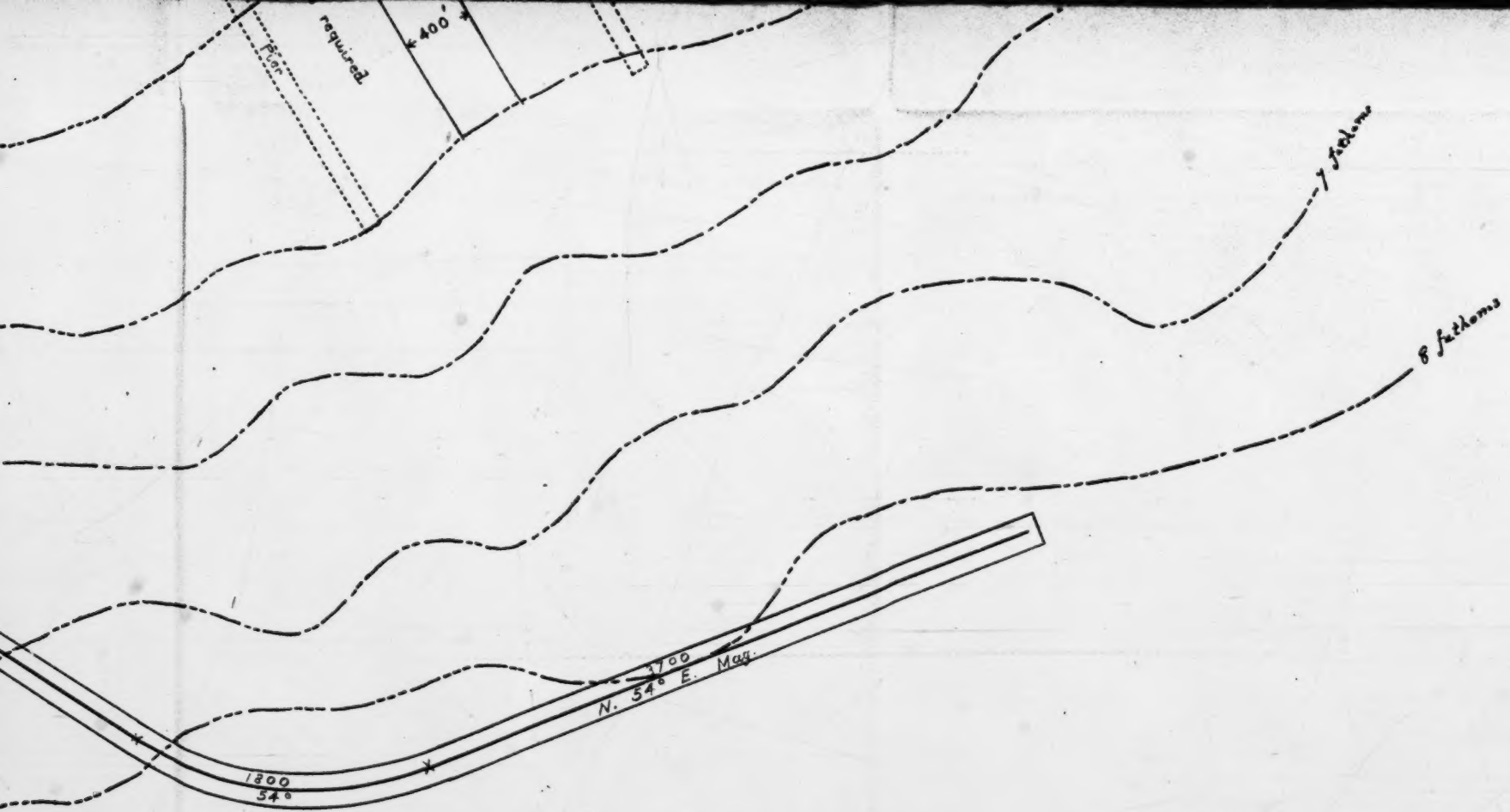
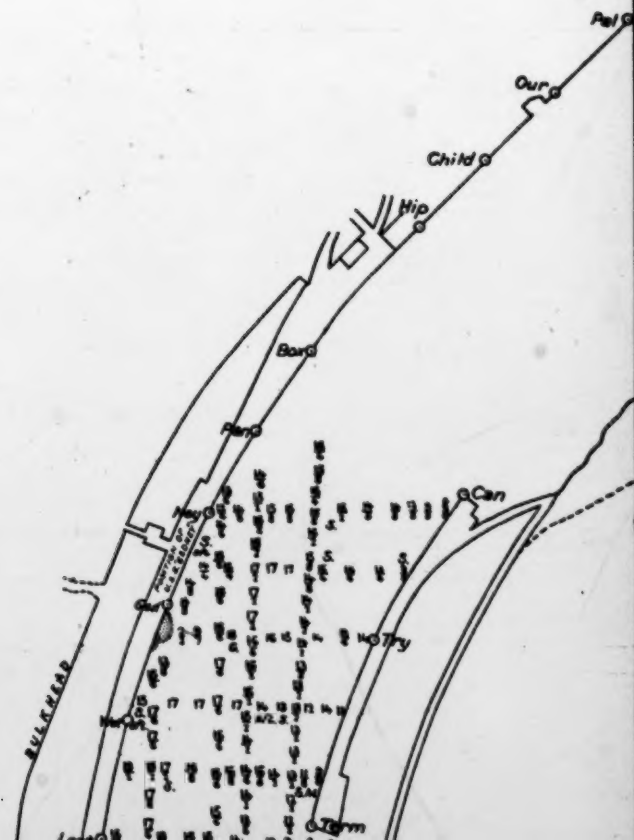
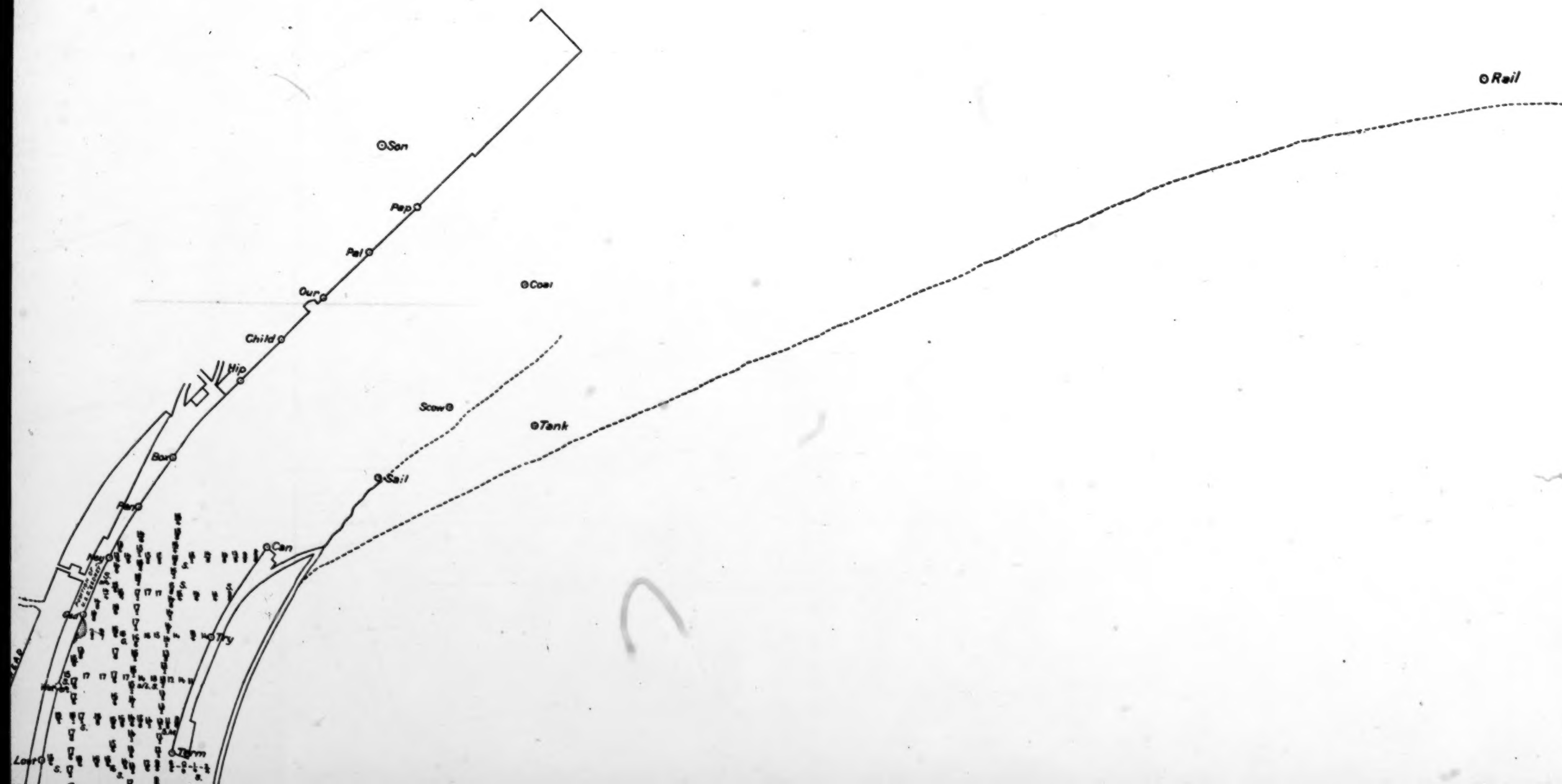


Chart
of
Inner Harbor at San Pedro,
showing Soundings made February 1897,
to accompany Report of Board for Locating
a Deep Water Harbor in Southern California.

SAN PEDRO



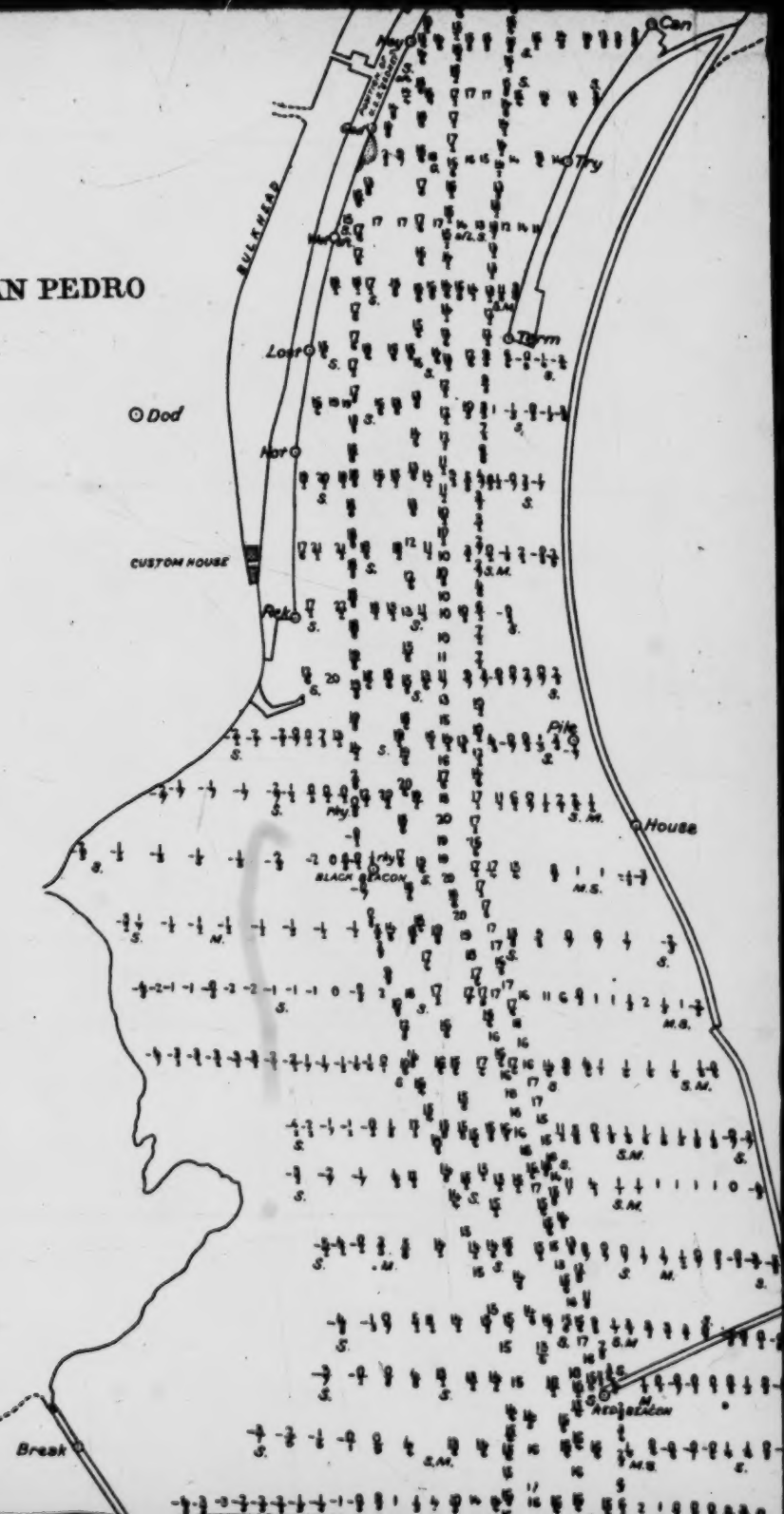


Statute Mile

0 $\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$

Nautical Mile

0 $\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$

 $\frac{1}{4} = 12.5 \text{ feet.}$ 

Frame

Break

Bite

Range

Root

Dead

End





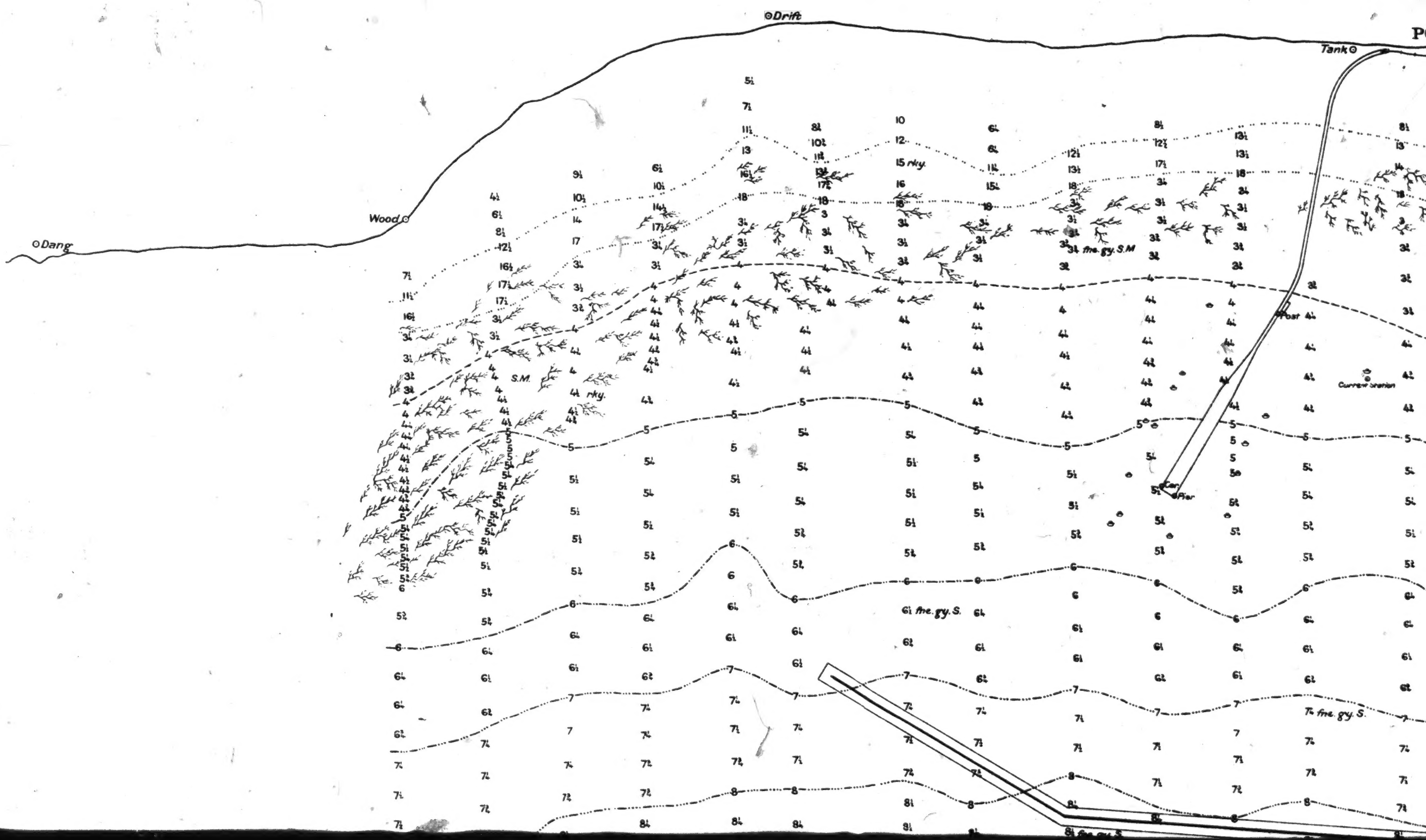
Frame ©

Bluff®

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

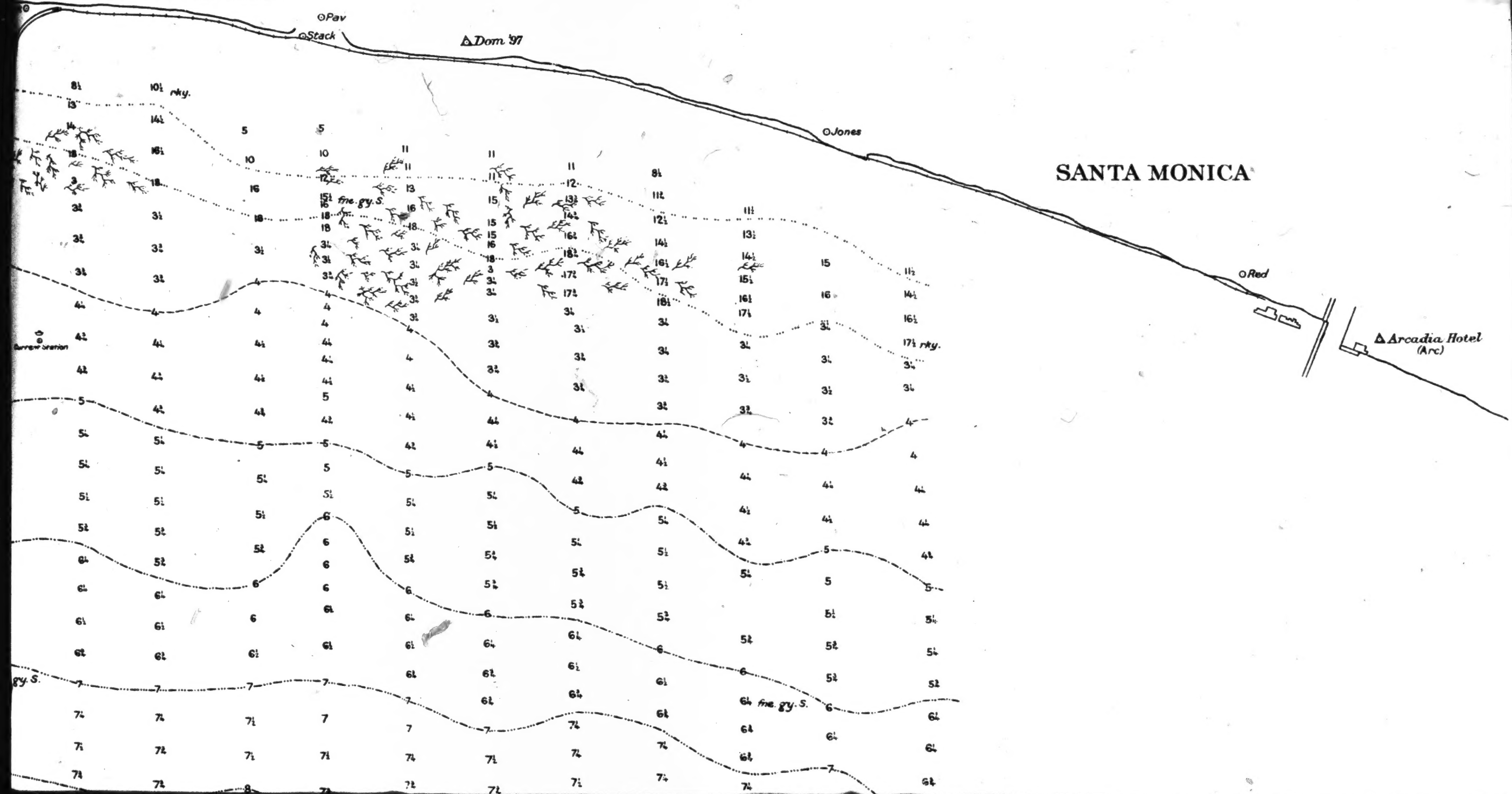
S. Doc. 185 55 1

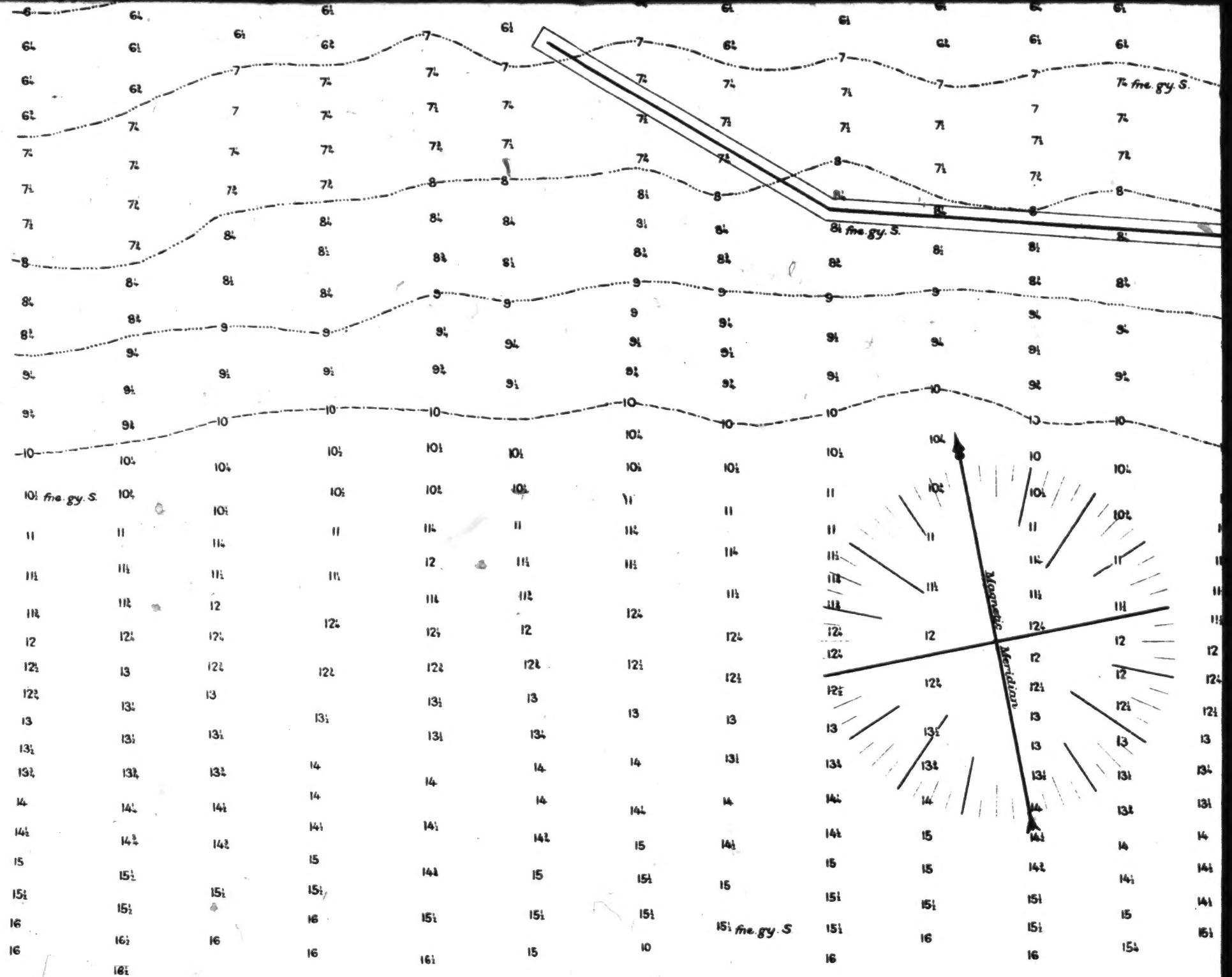
Chart
of
les and Santa Monica Bay,
tion of proposed Breakwater,
Report of Board for Locating
Harbor in Southern California.

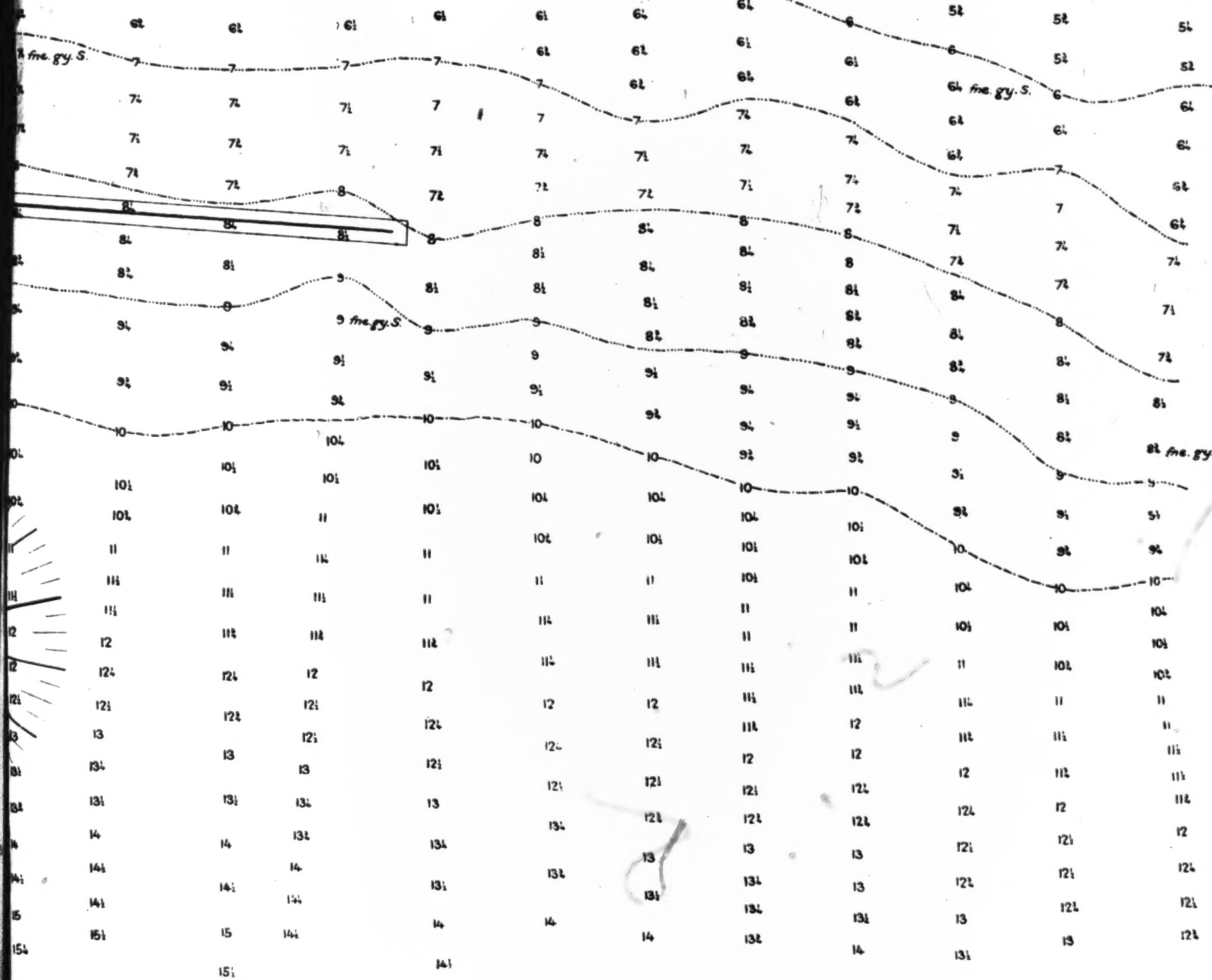


PORT LOS ANGELES

SANTA MONICA



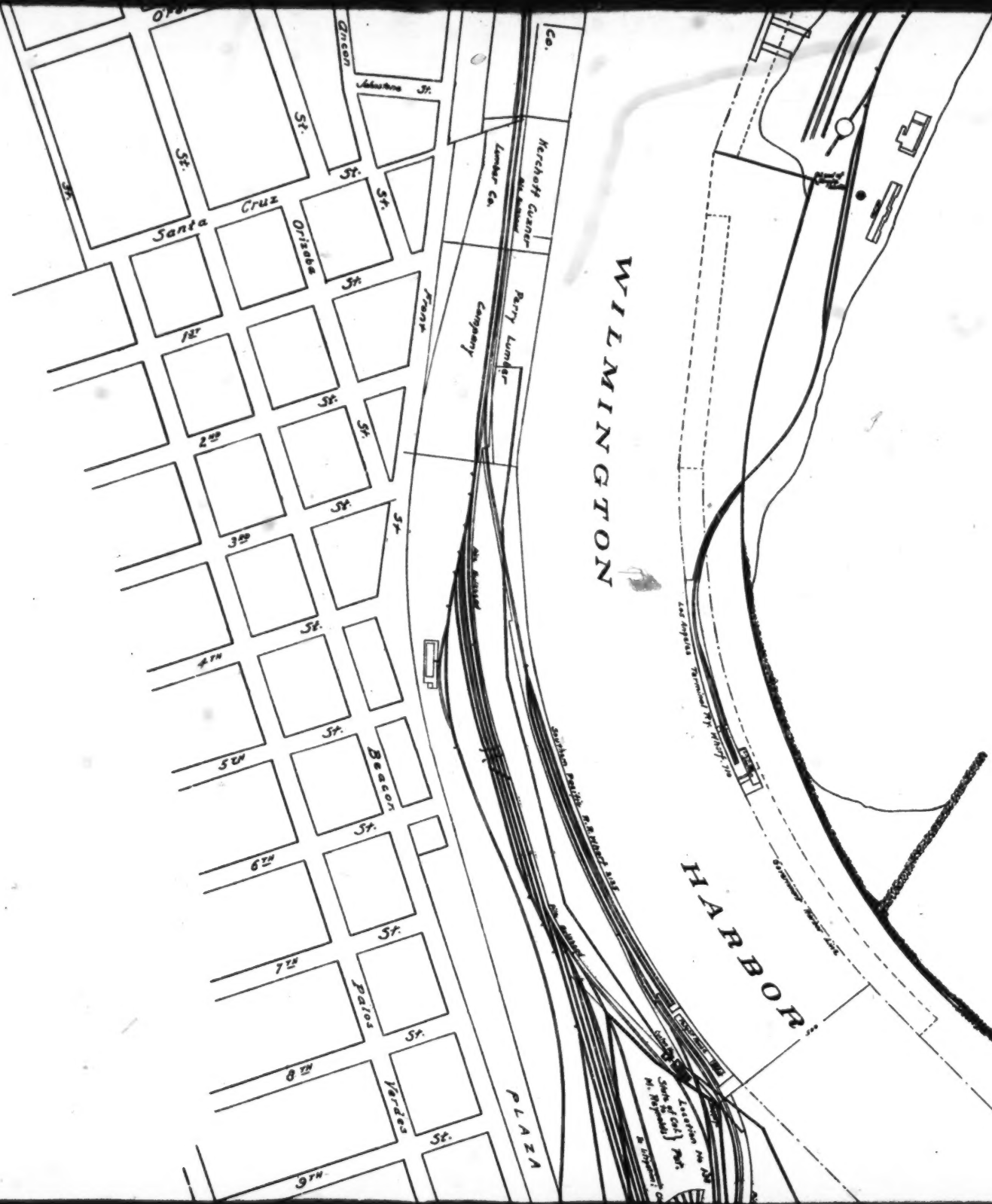






MAP OF

WILMINGTON DELAWARE



MAP OF **WILMINGTON HARBOR** AND VICINITY

SHOWING OWNERSHIP OF WATER FRONT OF PROPOSED
SAN PEDRO HARBOR

Compiled from Official Records & Other Authentic Sources

BY

J. O. Marsh, Draftsman

Los Angeles, Calif.

October, 1892.

Scale: 400 feet to 1 inch.





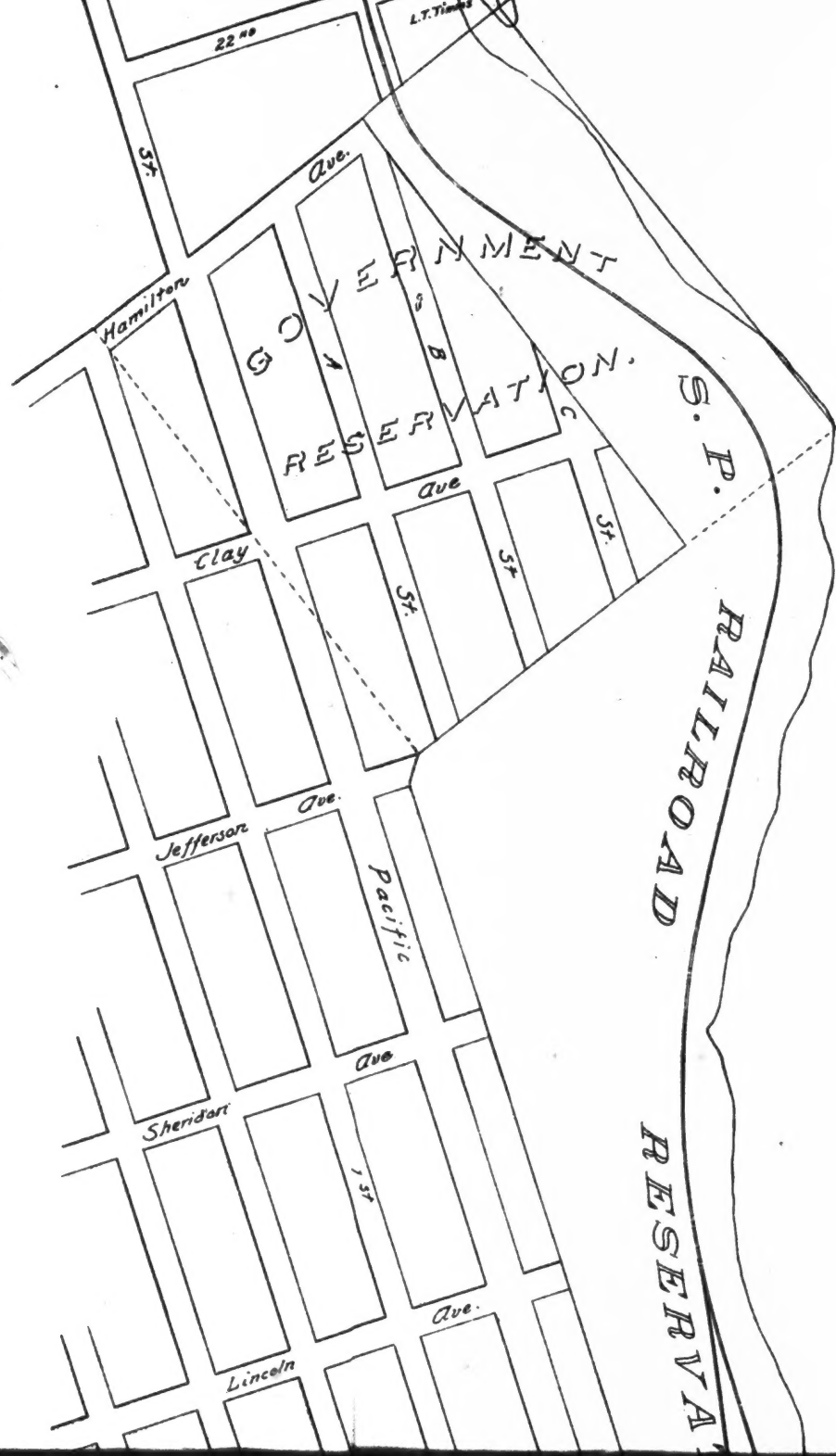
Breakwater

ENTRANCE
TO
HARBOR.

Deadmans
Island.

P. E. D. R. O.

VEFINMENT



N
W
S

OF

B
A
Y

BAY

RESERVATION

TOWN

SAN PEDRO HARBOR

Shenard

Lincoln

Scott

Washington

Grant

Sherman

Ave.

Ave.

Ave.

Ave.

Ave.

Ave.

1ST

2ND

3RD

4TH

5TH

6TH

7TH

8TH

9TH

ST.

ST.

ST.

ST.

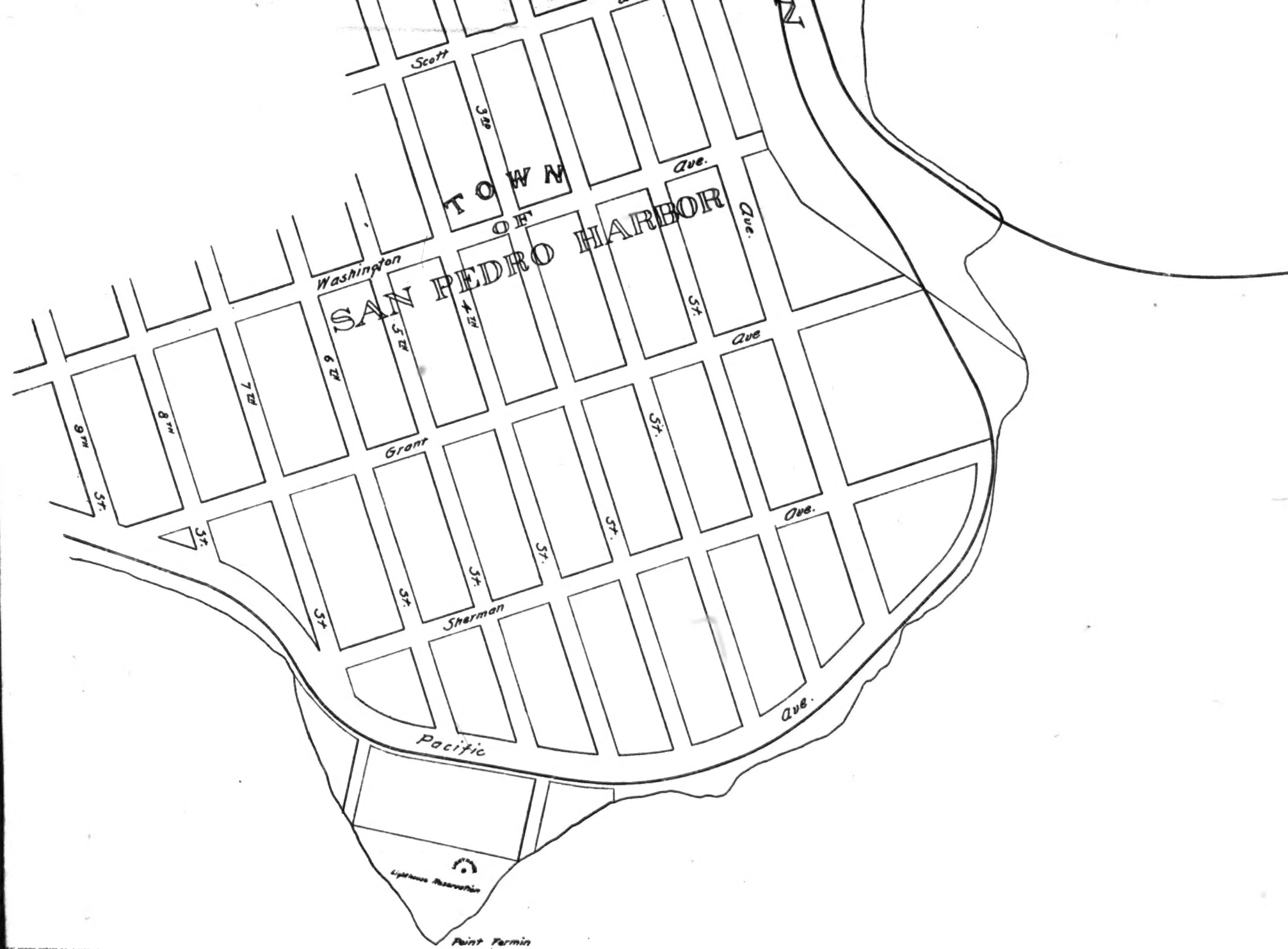
ST.

ST.

ST.

ST.

ST.



20.6
20.5
20.4
20.3
20.2
20.1
20.0
19.9
19.8
19.7
19.6
19.5
19.4
19.3
19.2
19.1
19.0
18.9
18.8
18.7
18.6
18.5
18.4
18.3
18.2
18.1
18.0
17.9
17.8
17.7
17.6
17.5
17.4
17.3
17.2
17.1
17.0
16.9
16.8
16.7
16.6
16.5
16.4
16.3
16.2
16.1
16.0
15.9
15.8
15.7
15.6
15.5
15.4
15.3
15.2
15.1
15.0
14.9
14.8
14.7
14.6
14.5
14.4
14.3
14.2
14.1
14.0
13.9
13.8
13.7
13.6
13.5
13.4
13.3
13.2
13.1
13.0
12.9
12.8
12.7
12.6
12.5
12.4
12.3
12.2
12.1
12.0
11.9
11.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1
11.0
10.9
10.8
10.7
10.6
10.5
10.4
10.3
10.2
10.1
10.0
9.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2
9.1
9.0
8.9
8.8
8.7
8.6
8.5
8.4
8.3
8.2
8.1
8.0
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.0
5.9
5.8
5.7
5.6
5.5
5.4
5.3
5.2
5.1
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0



Entrance to V





2

Entrance to Wilmington Harbor, Cal.

Survey of February 1894

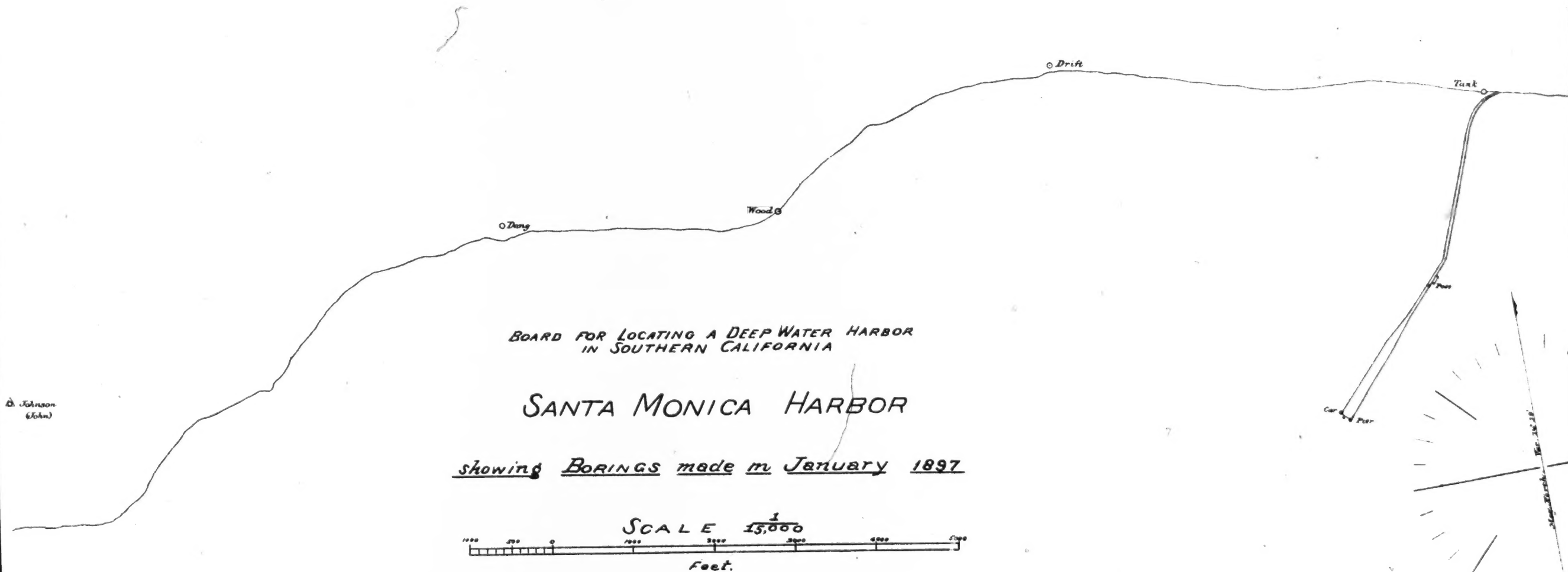
Scale 1 in = 200 ft.

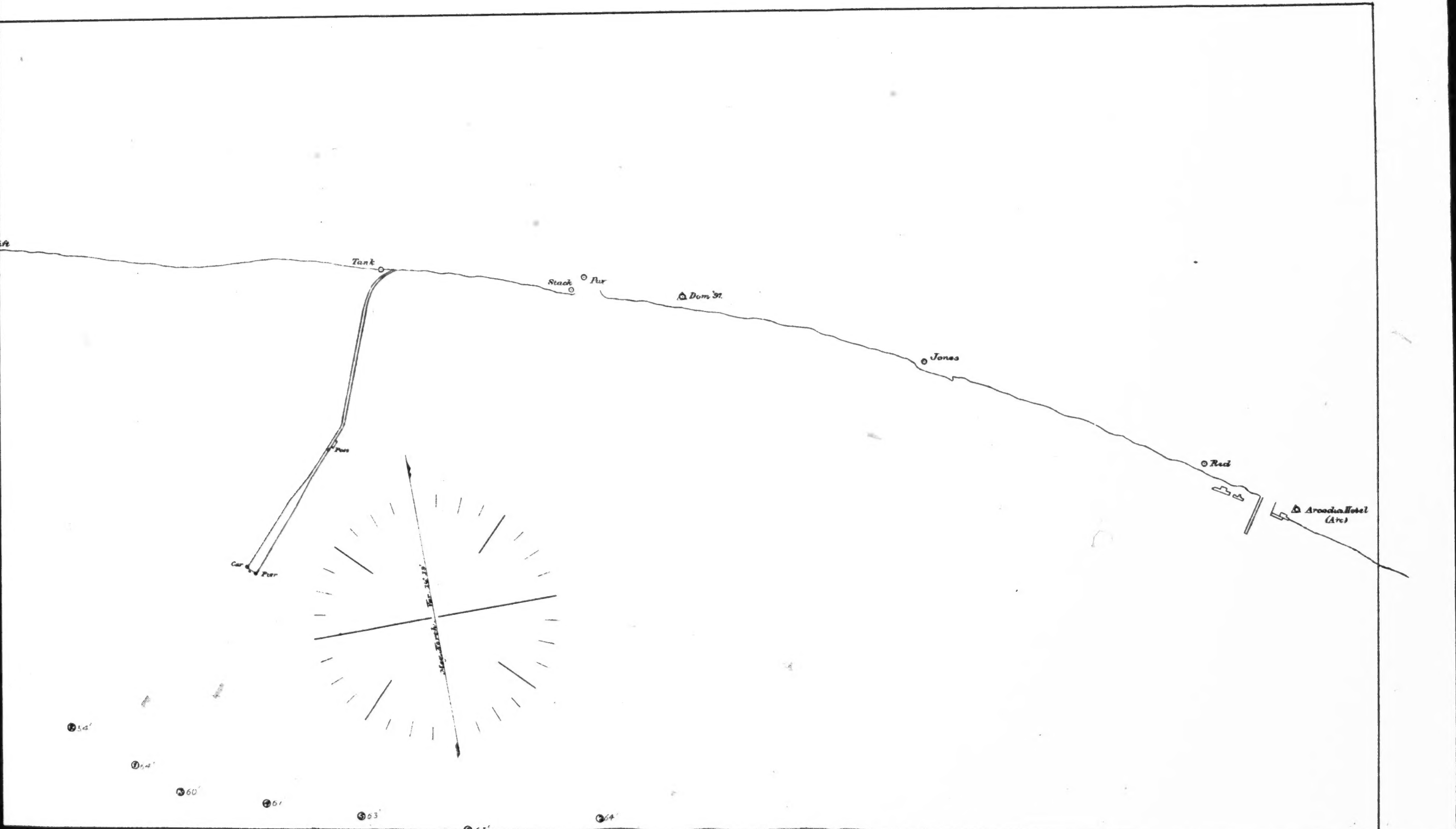
Forwarded To the Chief of Engineers U.S. Army.

With letter dated June 8th 1894

M. H. Denigand

Lieut. Col., Corps of Engineers.





BOARD FOR LOCATING A DEEP WATER HARBOR
IN SOUTHERN CALIFORNIA

SANTA MONICA HARBOR

showing BORINGS made in January 1897



Borings are indicated by numbered circles in black.
The depths are given in red figures, and refer to the
Plane of mean lower low water.

To accompany Report of Randell Hunt.

Asst. Eng^r



A Johnson
(John)

O Zuni

Wood

O Drift

Tank

Pier

Car Pier

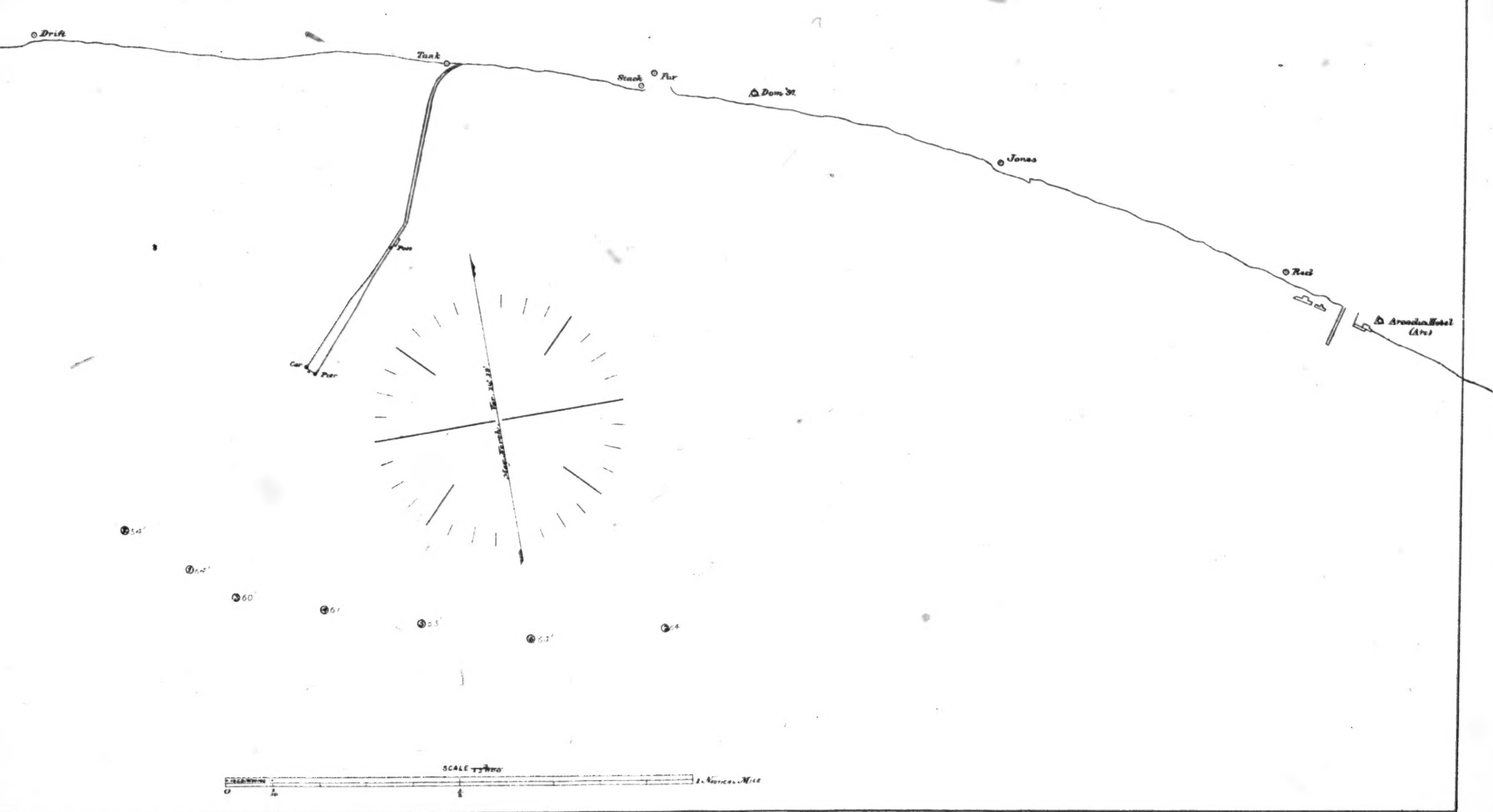
5.4'

10.4'

16.0'

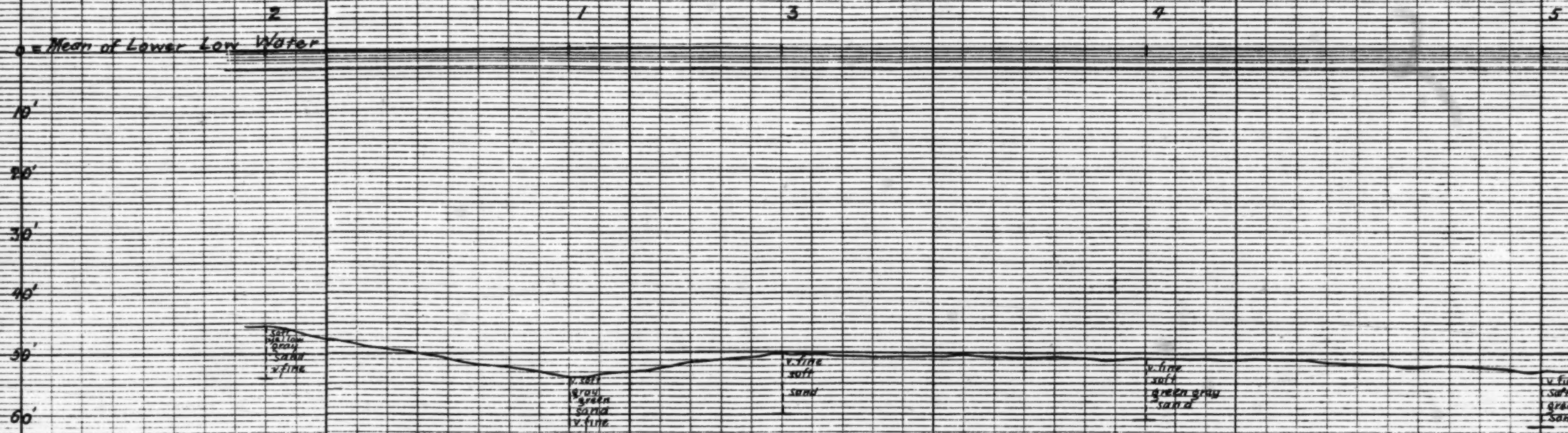
10.1'

10.5'



Board for Locating a Deep Water Harbor
In Southern California.

Borings on Li
Santa



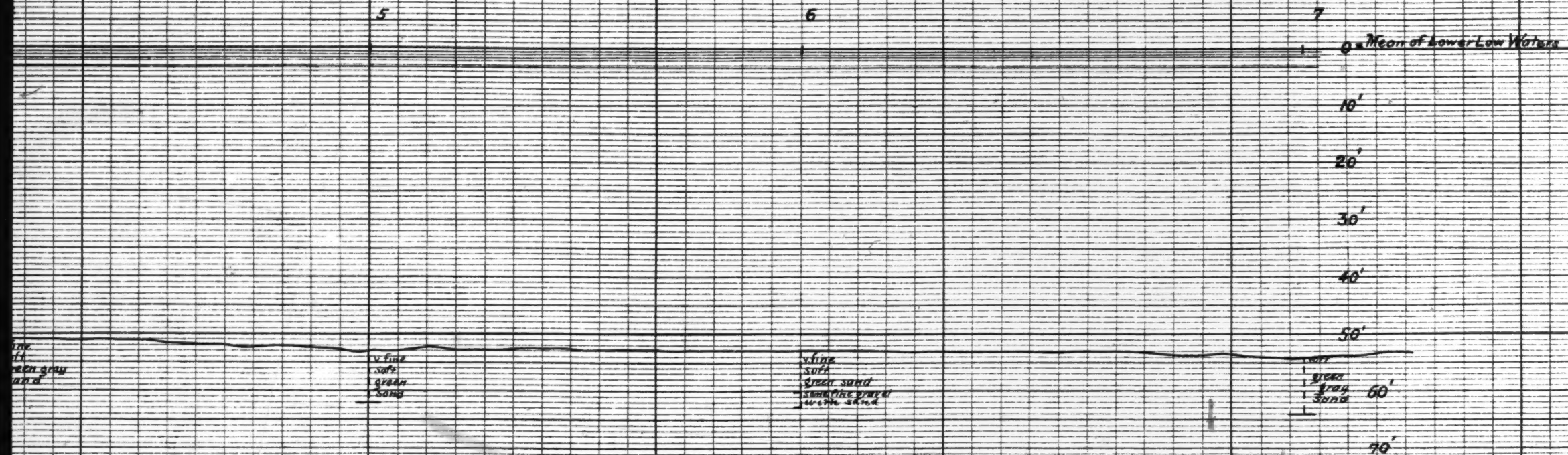
Note: The numbers refer to borings as recorded on Map and Table of Borings

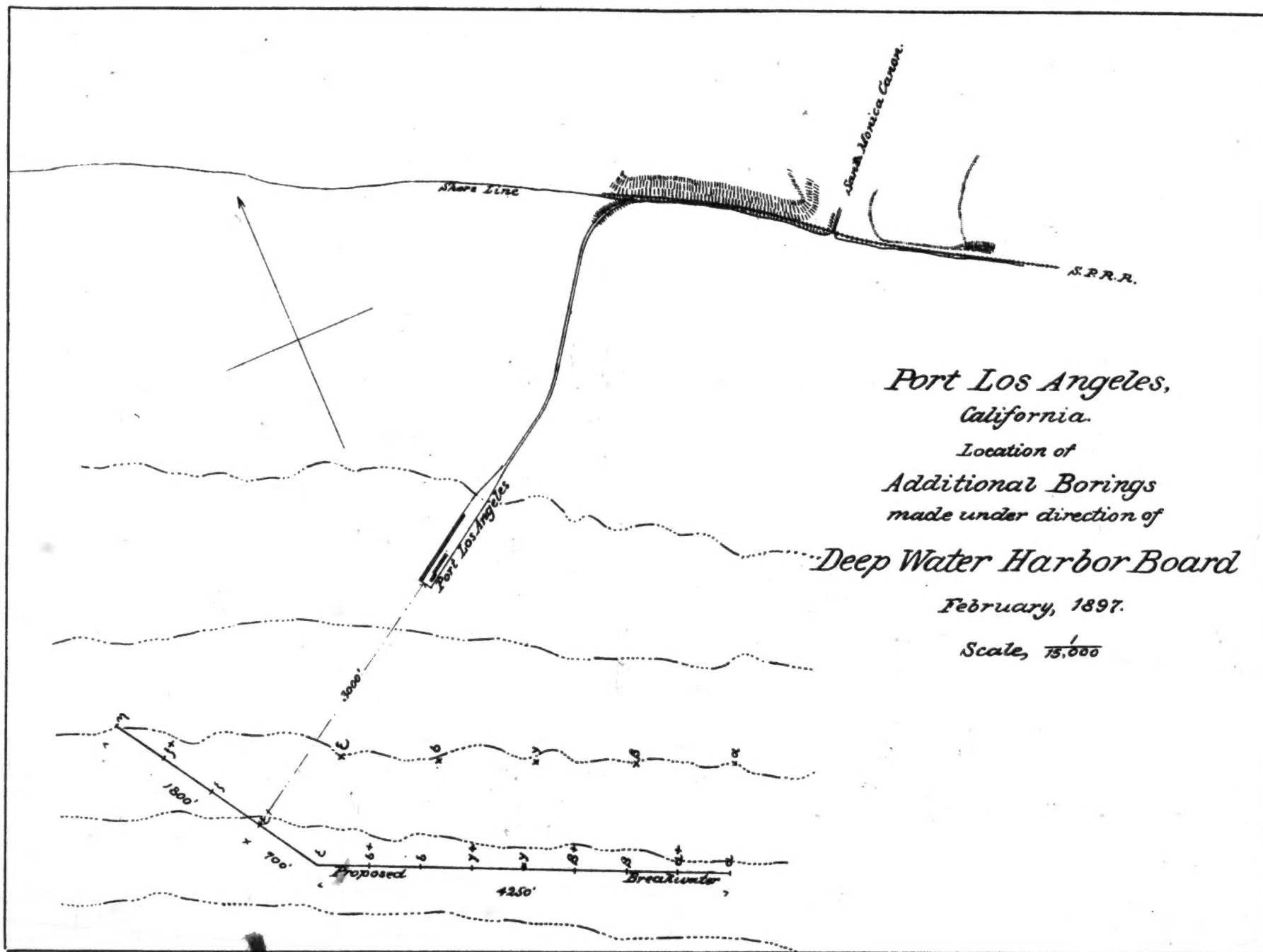
To accompany report of Randell Hunt

Asst. Eng^r

ep Water Harbor
ifornia.

Borings on Line of Proposed Breakwater
of
Santa Monica Cal.
January 1897.





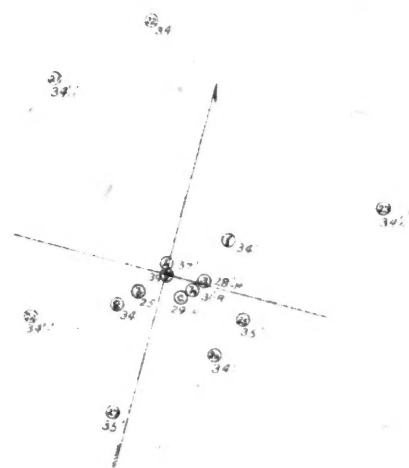
*Port Los Angeles,
California.*

*Location of
Additional Borings
made under direction of*

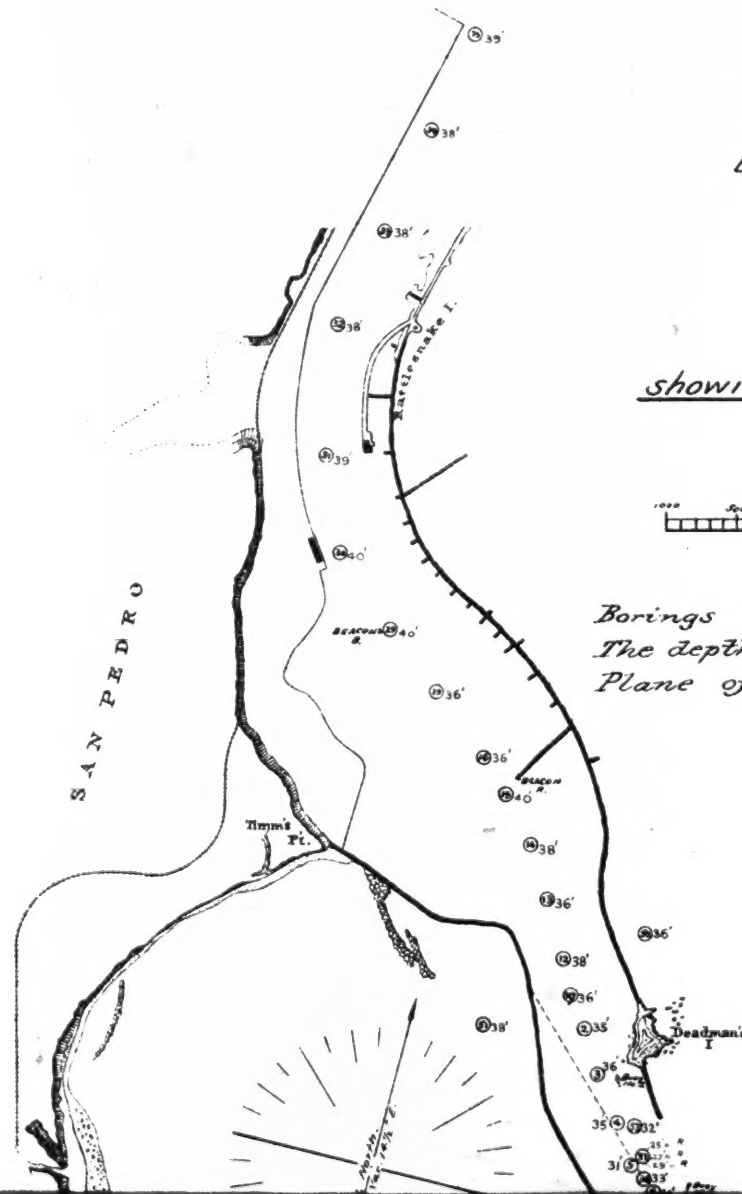
Deep Water Harbor Board

February, 1897.

Scale, $\frac{1}{15,000}$



— Additional Borings about No 7 —
— Scale 75 feet = 1 inch. —



BOARD FOR LOCATING A DEEP WATER HARBOR
IN SOUTHERN CALIFORNIA.

SAN PEDRO HARBOR

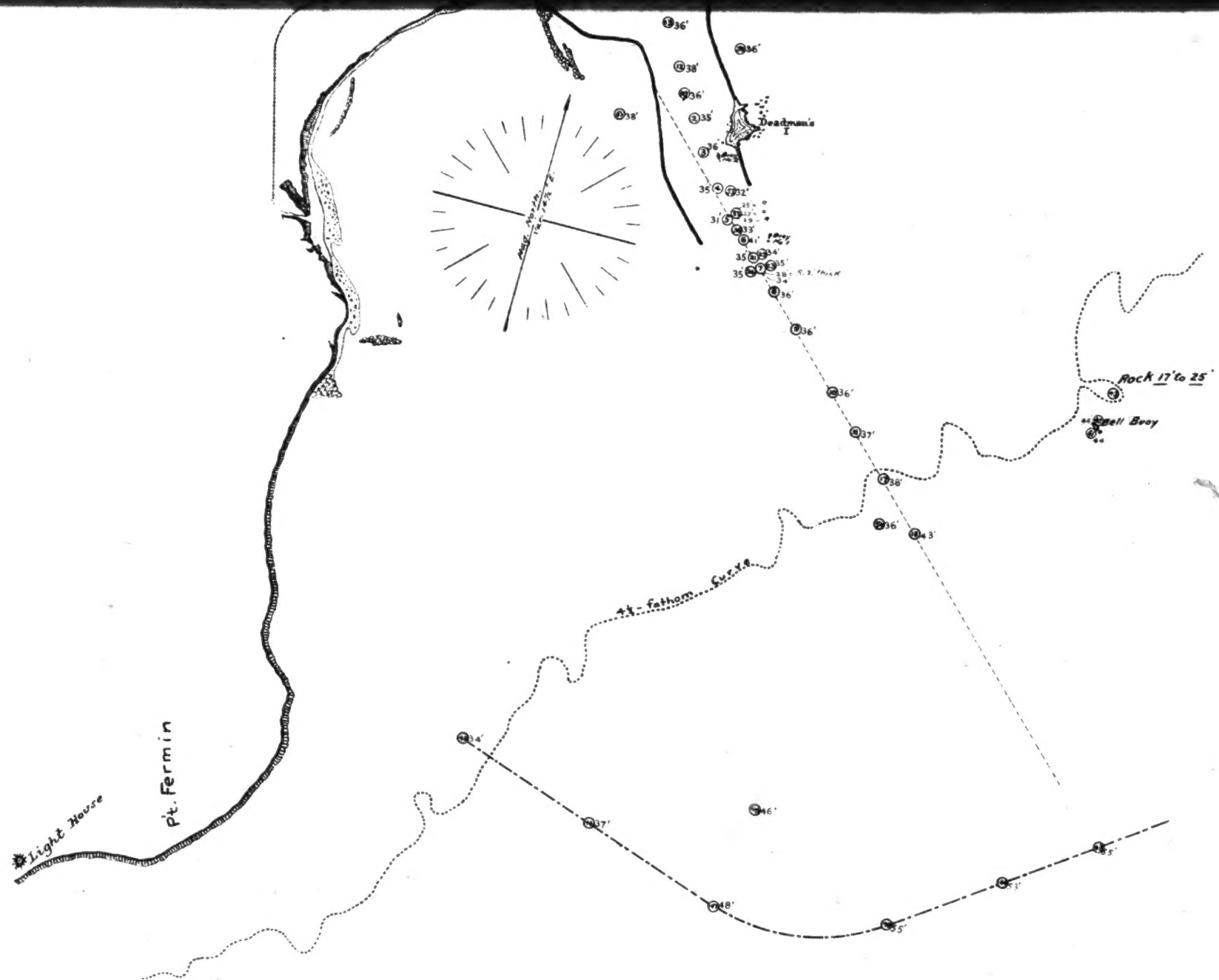
showing BORINGS made in January, 1897.



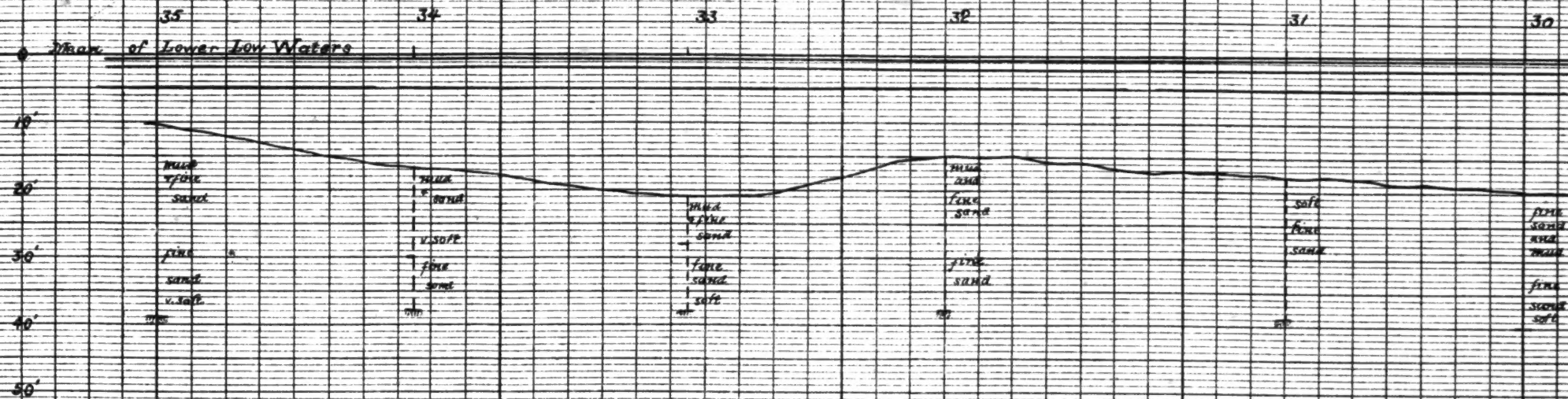
Borings are indicated by numbered circles in black.
The depths are given in red figures, and refer to the
Plane of mean lower low water.

To accompany Report of Randell Hunt.

Asst. Eng^r



Profile of Borings at San Pedro Harbor Cal.
January 1897



Scale
1" = 1000 feet

Note: The numbers refer to borings as recorded on Map and Table of Borings.

To accompany report of *Randell Hunt*
Asst. Eng.

S. Doc 1855 1

29

28

16

15

14

13

12

19

2

3

4

5

36

6

7

8

fine
sand
v. soft
fine
sand
v. soft

sand
sand
v. hard
clay

fine
gray
sand
v. soft

fine
gray
sand
soft

fine
gray
sand
soft

fine
gray
sand
soft

fine
gray
sand
soft

sand
with
some
shells
clay
& sand
v. hard

fine
black
clay

fine
black
clay

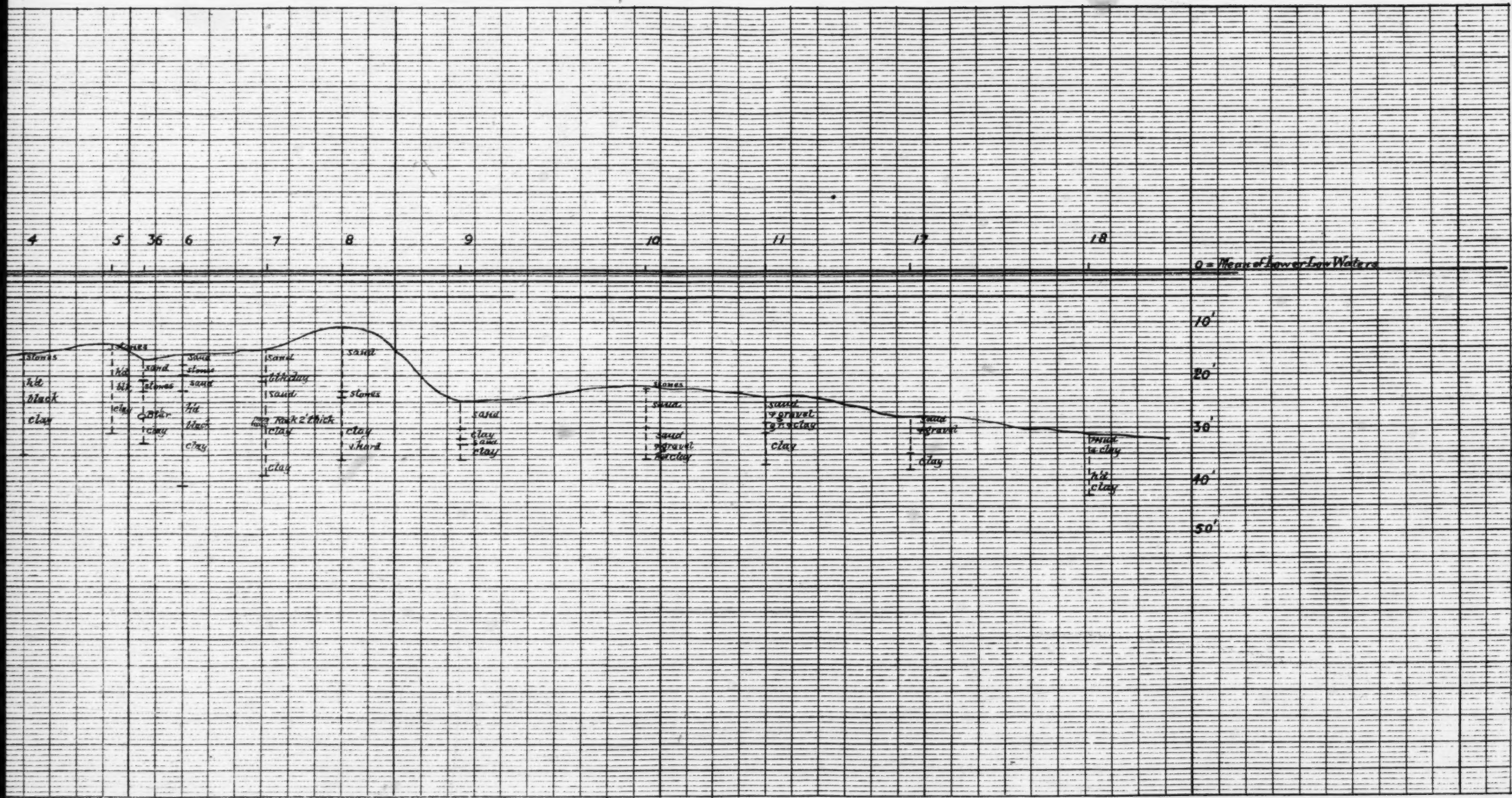
stones
fine
black
clay

stones
fine
black
clay

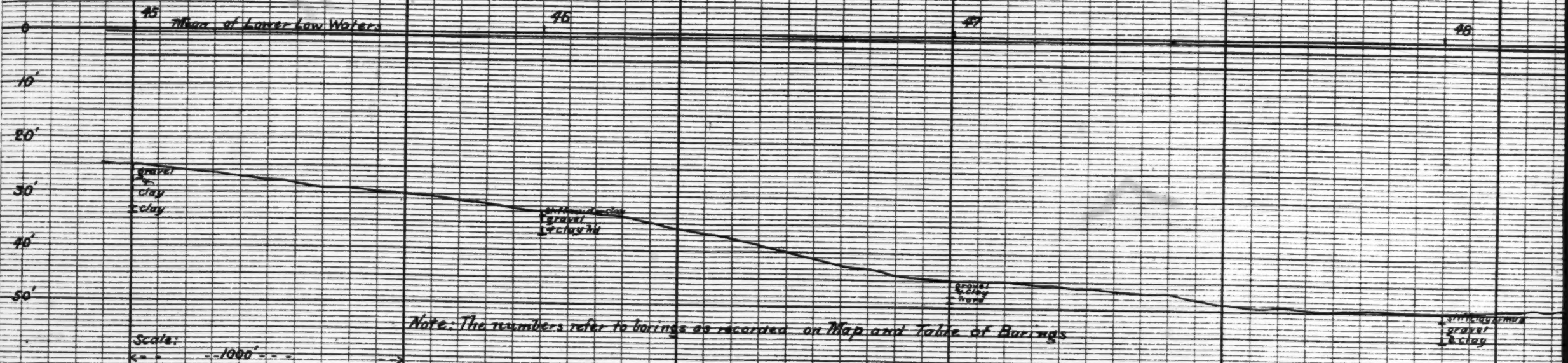
sand
stones
fine
black
clay

sand
fine
black
clay
v. hard

sand
stones
fine
black
clay
v. hard

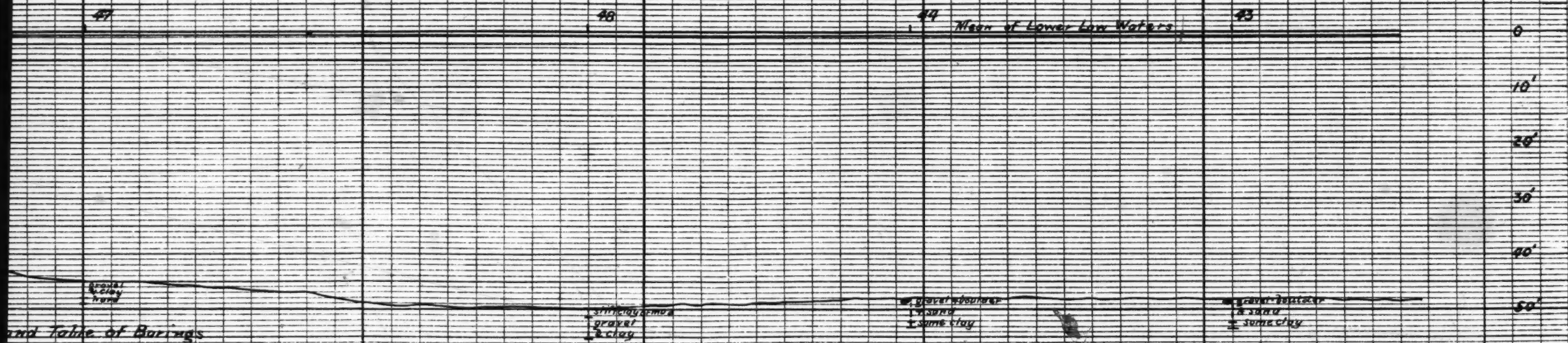


*Profile of Borings on Line of Projected Breakwater
at San Pedro Harbor Cal.*



*To accompany report of Randall Hunt
Asst. Engr*

Breakwater



and Table of Borings

5 Fathoms

NOTE

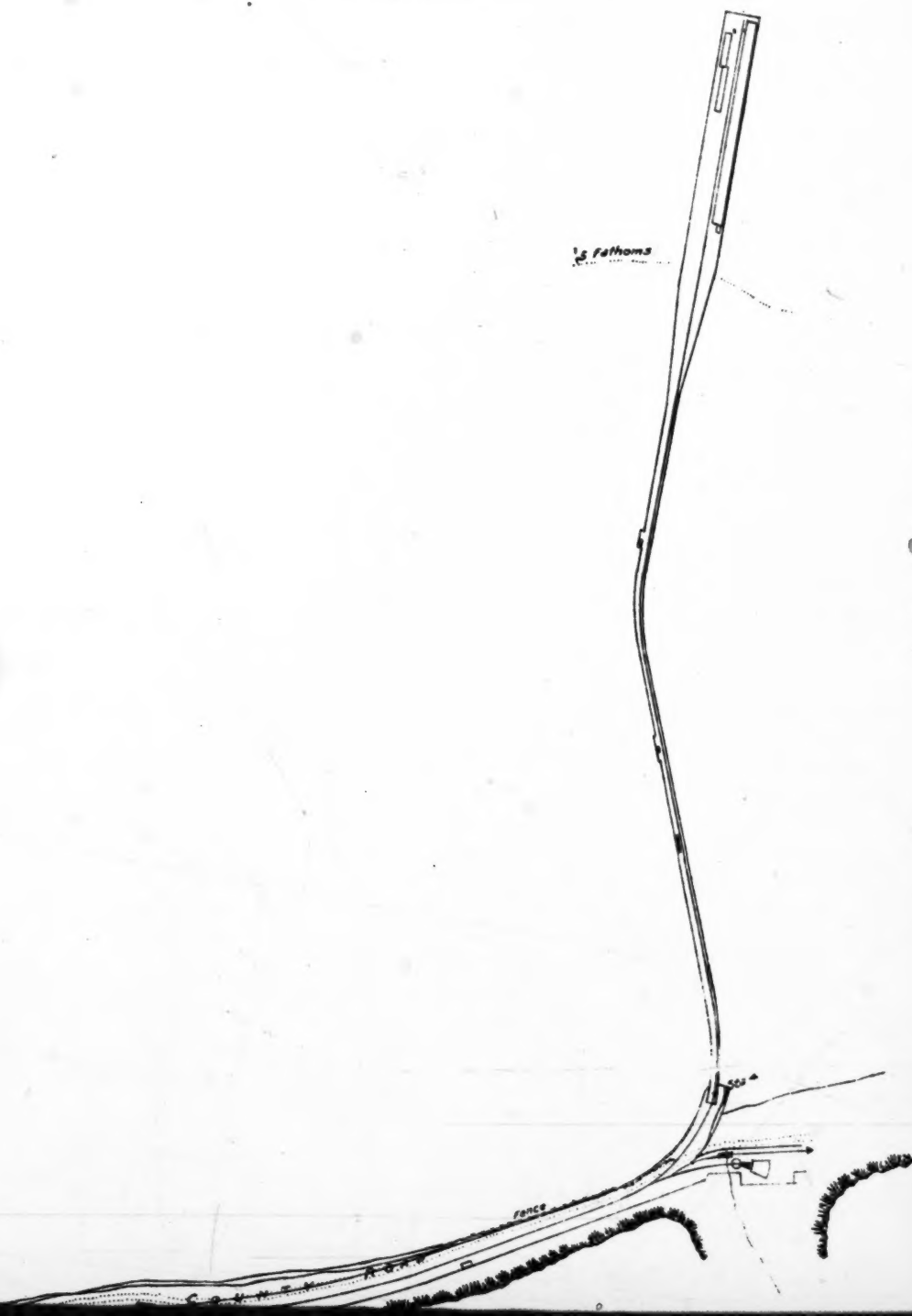
The High Water line of 8th Oct. 1896 was surveyed photographically under the direction of H. Hawgood, all photographs were taken within the twenty minutes immediately following the time of high water as given for that date in the Tide Tables for the Pacific Coast by the U. S. Coast & Geodetic Survey. The height of this tide according to the Tables was 7.1 ft. above datum. The highest tide for the year being 7.5 ft. above.

The High Water line marked U. S. C & G. Survey has been taken from a chart dated 1893, on scale of 1/10000, of the detailed surveys made by the United States Coast & Geodetic Survey in Feb. Mar. 1893 at the request and expense of the Southern Pacific Co.

NOTE

The High Water line of 8th Oct. 1896 was surveyed photographically under the direction of H. Hawgood, all photographs were taken within the twenty minutes immediately following the time of high water as given for that date in the Tide Tables for the Pacific Coast by the U. S. Coast & Geodetic Survey. The height of this tide according to the Tables was 7.1 ft above datum. The highest tide for the year being 7.4 ft. above.

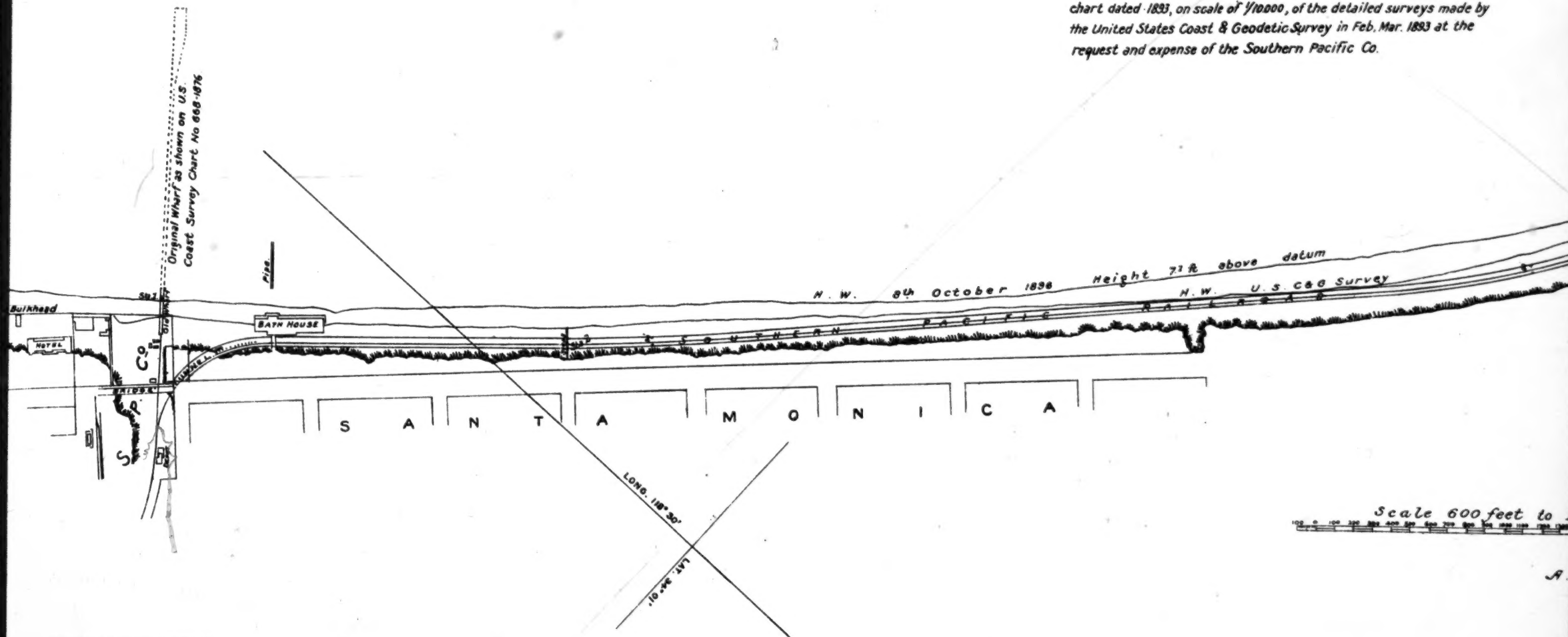
The High Water line marked U. S. C & G. Survey has been taken from a chart dated 1893, on scale of 1/10000, of the detailed surveys made by the United States Coast & Geodetic Survey in Feb. Mar. 1893 at the request and expense of the Southern Pacific Co.



NOTE

The High Water line of 8th Oct. 1896 was surveyed photographically under the direction of H. Hawgood, all photographs were taken within the twenty minutes immediately following the time of high water as given for that date in the Tide Tables for the Pacific Coast by the U. S. Coast & Geodetic Survey. The height of this tide according to the Tables was 7.1 ft above datum. The highest tide for the year being 7.5 ft above.

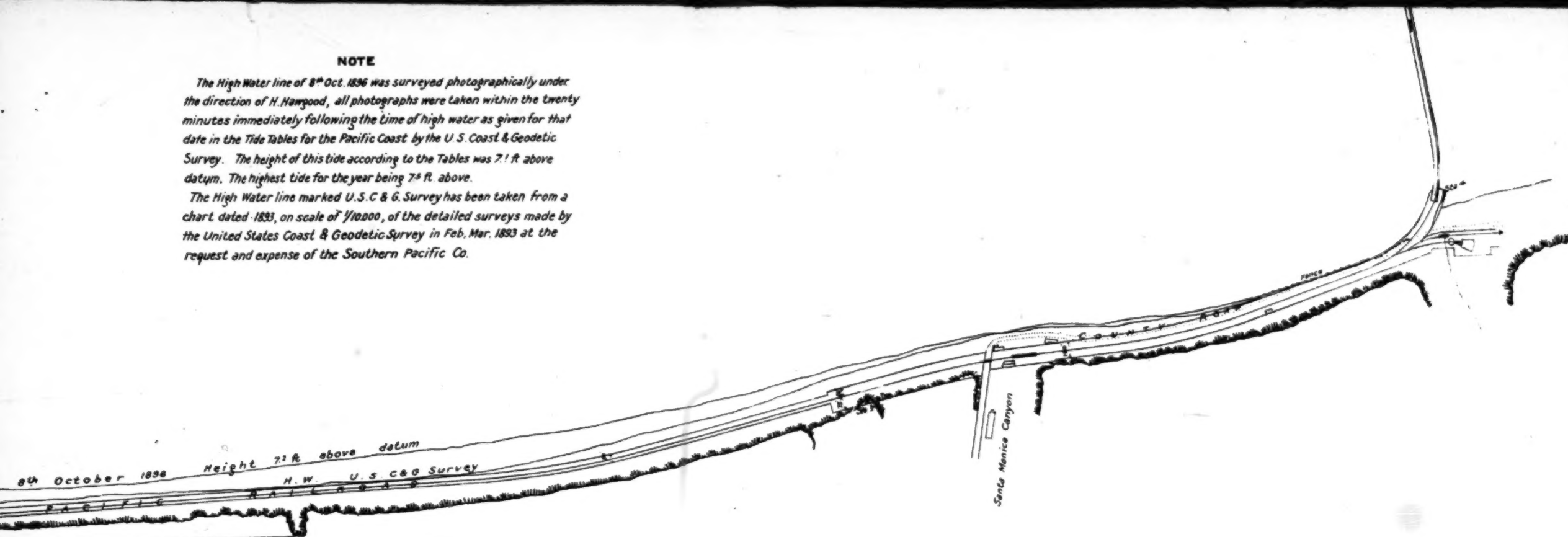
The High Water line marked U. S. C & G. Survey has been taken from a chart dated 1893, on scale of 1/10000, of the detailed surveys made by the United States Coast & Geodetic Survey in Feb. Mar. 1893 at the request and expense of the Southern Pacific Co.



NOTE

The High Water line of 8th Oct. 1896 was surveyed photographically under the direction of H. Hamgood, all photographs were taken within the twenty minutes immediately following the time of high water as given for that date in the Tide Tables for the Pacific Coast by the U. S. Coast & Geodetic Survey. The height of this tide according to the Tables was 7.1 ft above datum. The highest tide for the year being 7.5 ft. above.

The High Water line marked U. S. C & G. Survey has been taken from a chart dated 1893, on scale of 1/10000, of the detailed surveys made by the United States Coast & Geodetic Survey in Feb. Mar. 1893 at the request and expense of the Southern Pacific Co.



Scale 600 feet to 1 inch.

A. Hamgood M. Sur. C. & G.
Nov. 1896.

Profile of portions of the line of the Southern Pacific Railroad

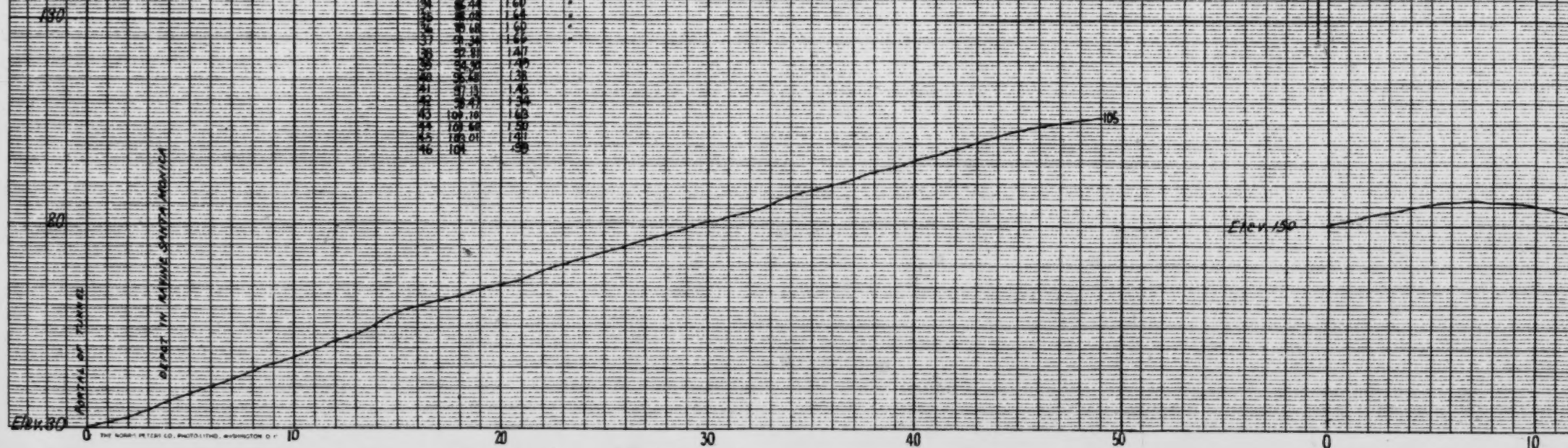
Santa Monica to Los Angeles

Sta	ELEVATION	GRADE	REMARKS
0	30.00	+	Station 0 at Portal of Tunnel Elevation 30 ft above assumed datum plane.
1	31.39	+1.39	On Curve
2	32.71	+1.32	"
3	34.44	+1.73	"
4	36.46	2.02	Tangent
5	38.37	1.91	Curve
6	40.02	1.65	"
7	41.78	1.76	"
8	43.80	2.02	Tangent
9	45.71	1.91	"
10	47.42	1.65	"
11	49.25	1.83	"
12	51.15	1.90	"
13	52.84	1.69	"
14	55.04	2.20	Curve
15	56.20	2.16	"
16	57.30	1.90	"
17	58.24	1.14	Point where line to Depot on bluff leaves Main Line
18	59.18	1.16	Tangent
19	60.10	1.45	"
20	61.12	1.54	"
21	62.10	1.48	"
22	63.24	1.60	"
23	64.10	1.61	"
24	65.11	1.61	"
25	66.21	1.58	"
26	67.63	1.44	"
27	68.16	1.50	"
28	69.10	1.30	"
29	70.50	1.41	"
30	71.30	1.41	"
31	72.10	1.41	"
32	73.27	1.46	"
33	74.34	1.57	"
34	75.44	1.60	"
35	76.08	1.64	"
36	77.68	1.60	"
37	78.34	1.66	"
38	79.81	1.47	"
39	81.30	1.49	"
40	82.40	1.38	"
41	83.13	1.45	"
42	84.47	1.34	"
43	104.10	1.63	"
44	105.68	1.58	"
45	106.01	1.41	"
46	104	1.30	"

Note The levels from which this profile was plotted were taken by me at the request of the Free Harbor League on Dec 17th 1896

Sam'l B. Bennett

Sta	ELEV	GRADE	REMARKS
0	130		Levels at summit near The Palms Sta 150 ft above Assumed Datum Plane
1	151.15	+1.15	On Curve
2	152.27	+1.12	"
3	153.80	+1.53	"
4	154.17	+0.37	"
5	155.07	+0.90	"
6	155.61	+0.54	"
7	155.76	+0.15	"
8	155.00	-0.76	"
9	155.11	-0.89	"
10	154.63	-0.48	"
11	153.85	-0.78	"
12	152.95	-0.90	"



Profile of portions of the line of the Southern Pacific Railroad

Santa Monica to Los Angeles

REMARKS

at Portal of Tunnel Elevation 30 ft above assumed datum plane.
(levels taken on rail)

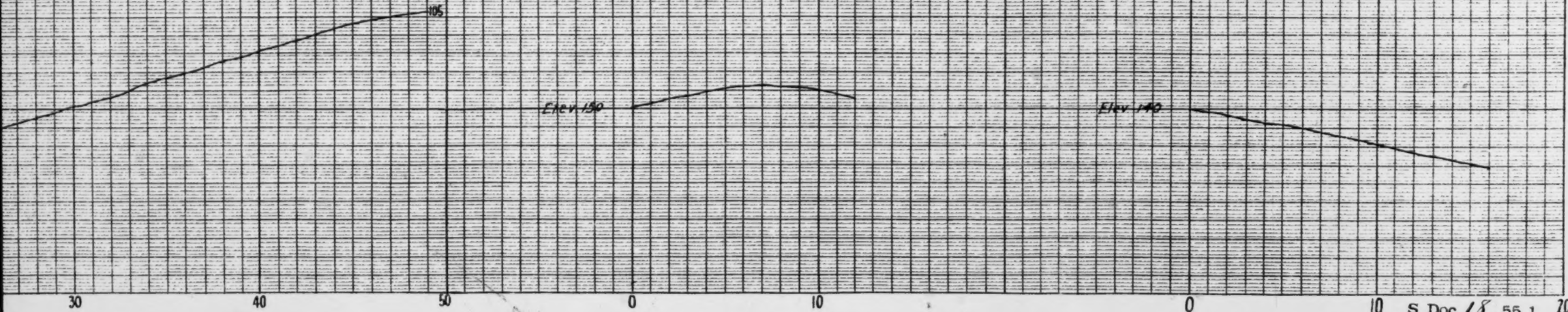
Note The levels from which this profile was plotted
were taken by me at the request of the Free
Harbor League on Dec 17th 1896

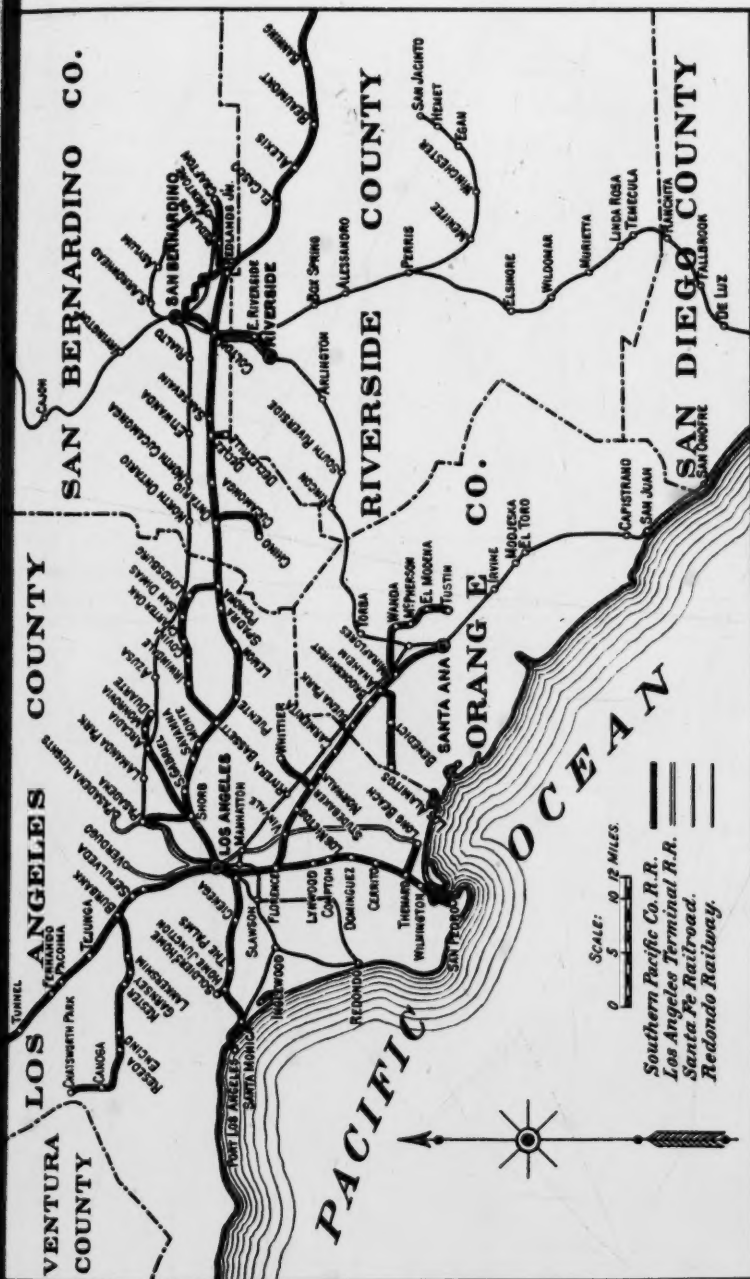
Sam'l E. Bennett

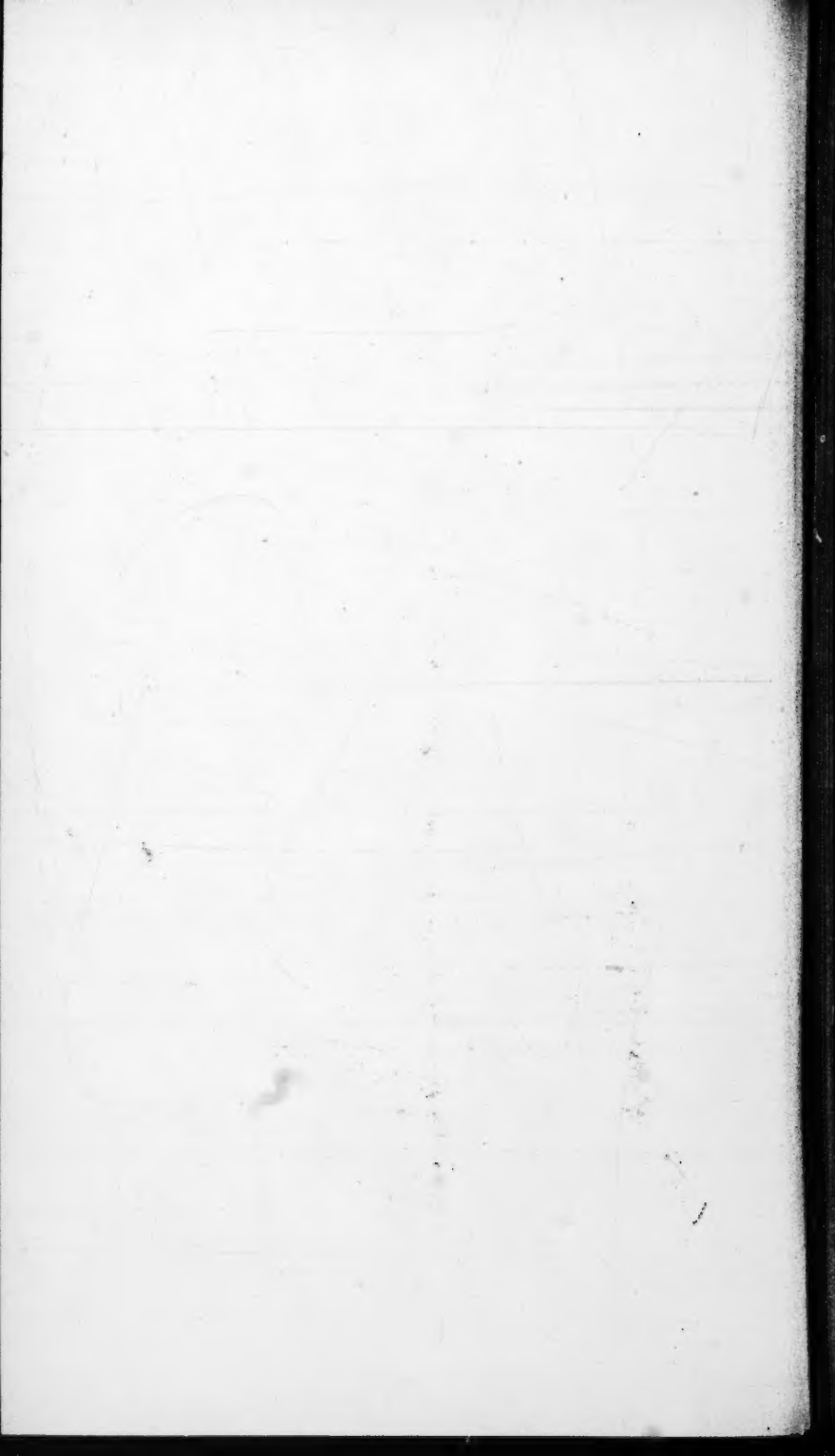
where line to Depot on bluff leaves Main Line

STA	ELEV	GRADE	REMARKS
0	150.00		Levels at summit near The Palms Sta 0 150 ft above Assumed datum plane on curve
1	151.13	+1.13	
2	152.27	+1.14	
3	153.09	+0.82	
4	154.17	+1.08	
5	155.07	+0.90	
6	155.61	+0.54	
7	155.76	+0.15	
8	155.80	-0.06	
9	155.11	-0.67	
10	154.63	-0.48	
11	153.83	-0.80	
12	152.99	-1.10	

STA	ELEV	GRADE	REMARKS
0	140.00		Sta 1000 ft. Elevation 140 above Assumed datum plane Elevation 140 above Assumed datum plane Tangent.
1	139.05	-0.95	
2	138.18	-0.87	
3	137.50	-0.68	
4	136.35	-1.15	
5	135.48	-0.87	
6			
7			
8			
9	131.85	-1.00	
10	130.84	-0.94	
11	129.41	-1.43	
12			
13			
14			
15	125.41	-1.00	







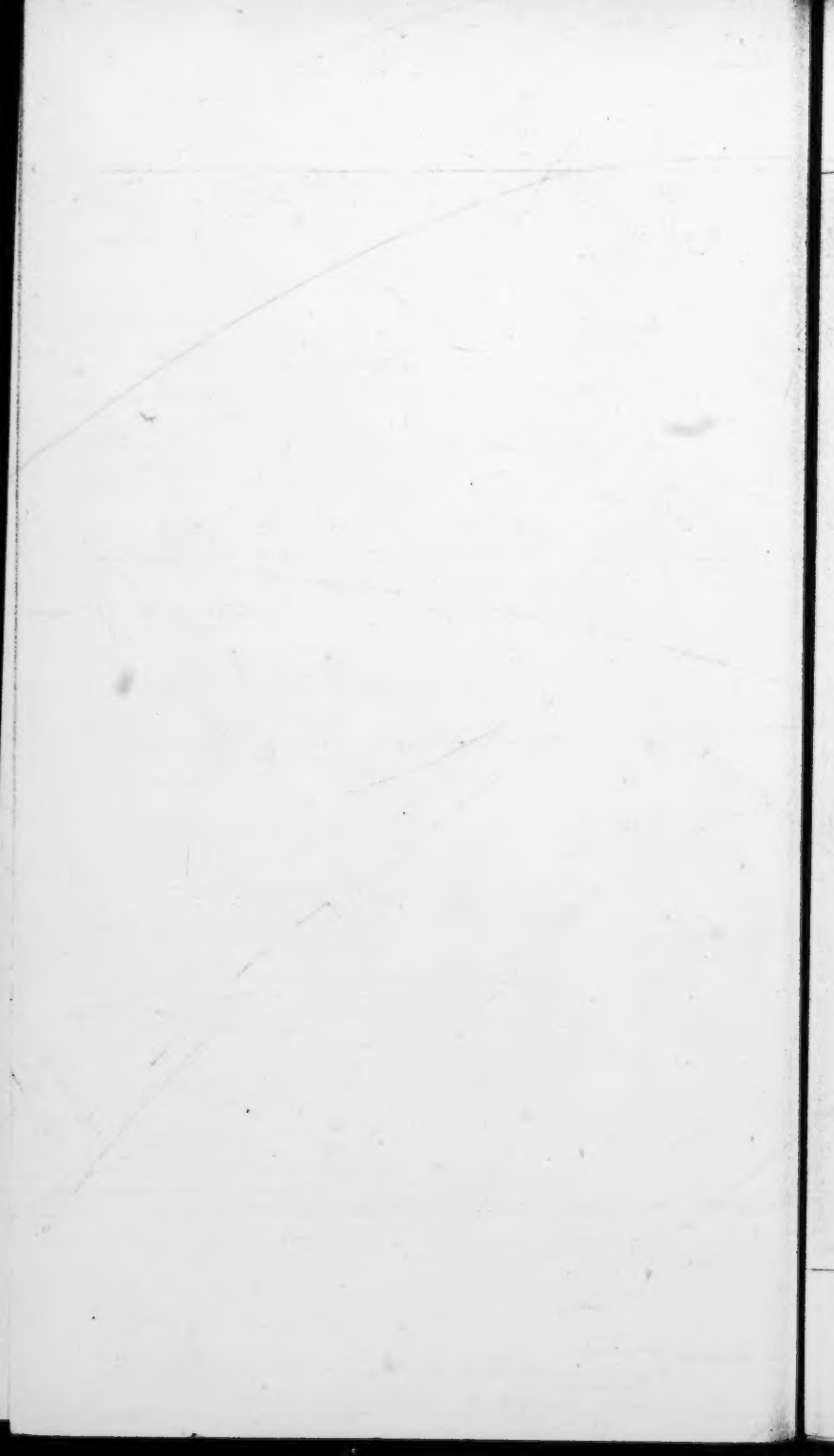


LEAGUE EXHIBIT No. 2, STATION 1, LOOKING EAST.



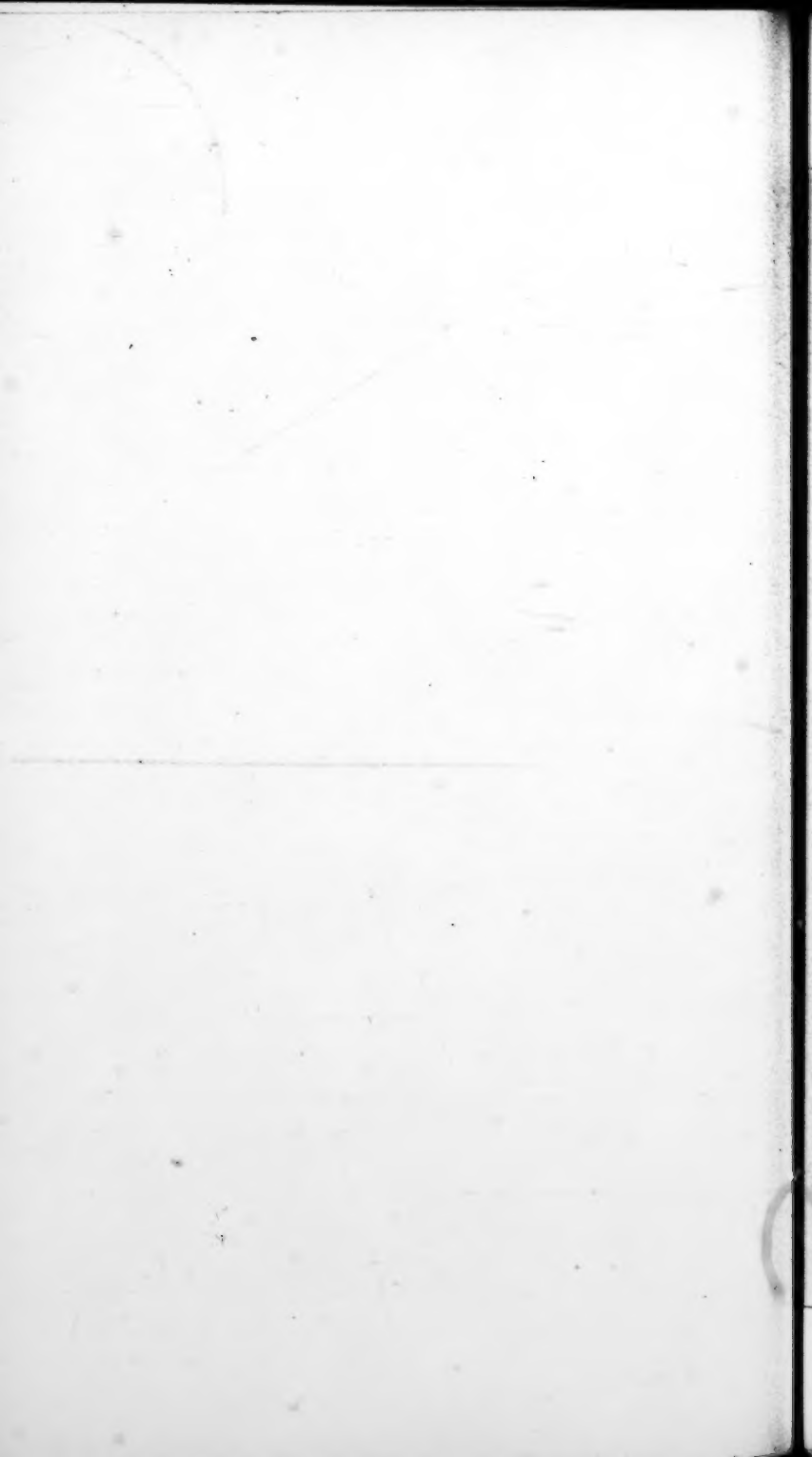


LEAGUE EXHIBIT No. 2, STATION 1, LOOKING WEST.



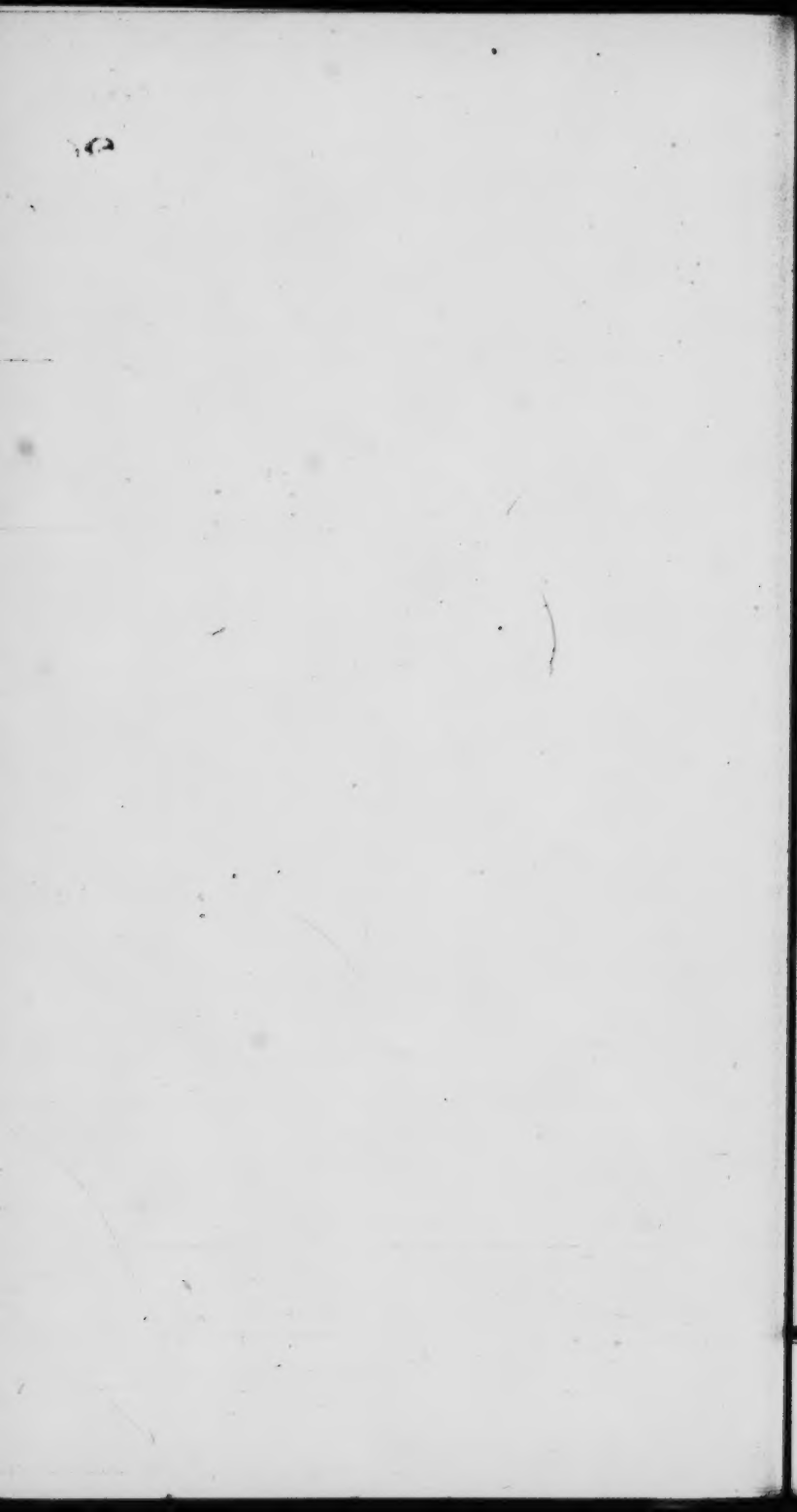


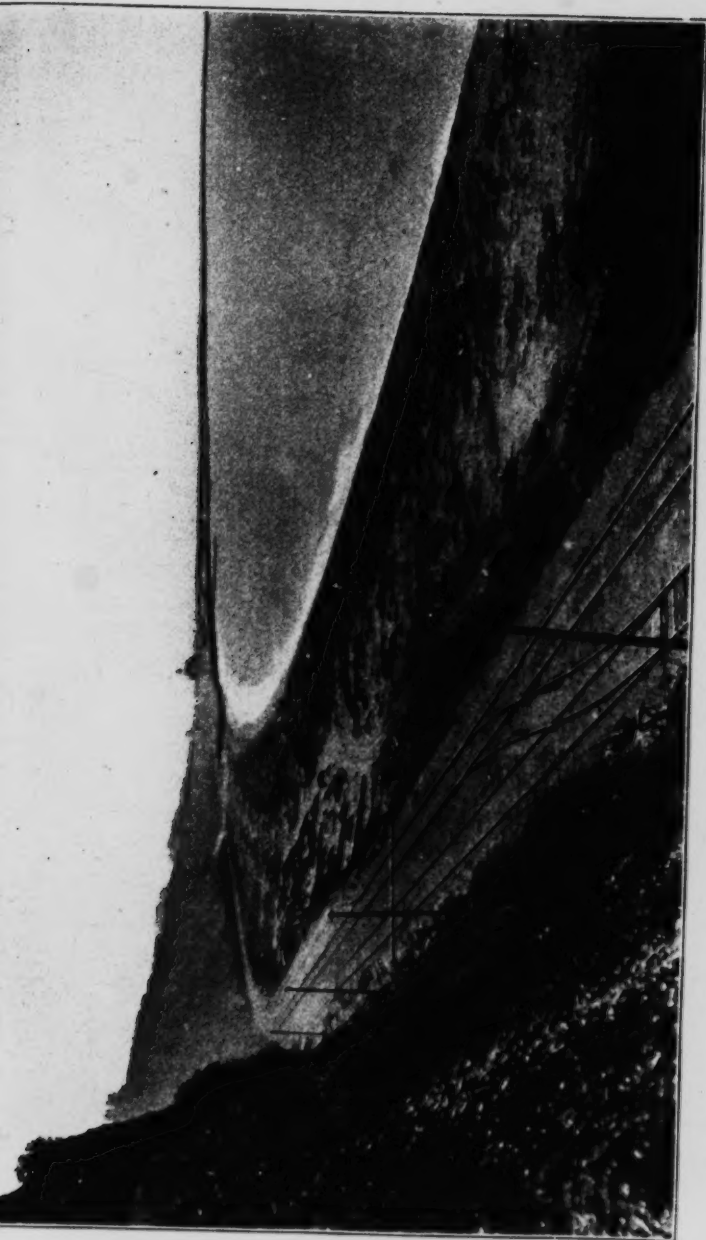
LEAGUE EXHIBIT NO. 2, STATION 2, LOOKING EAST.



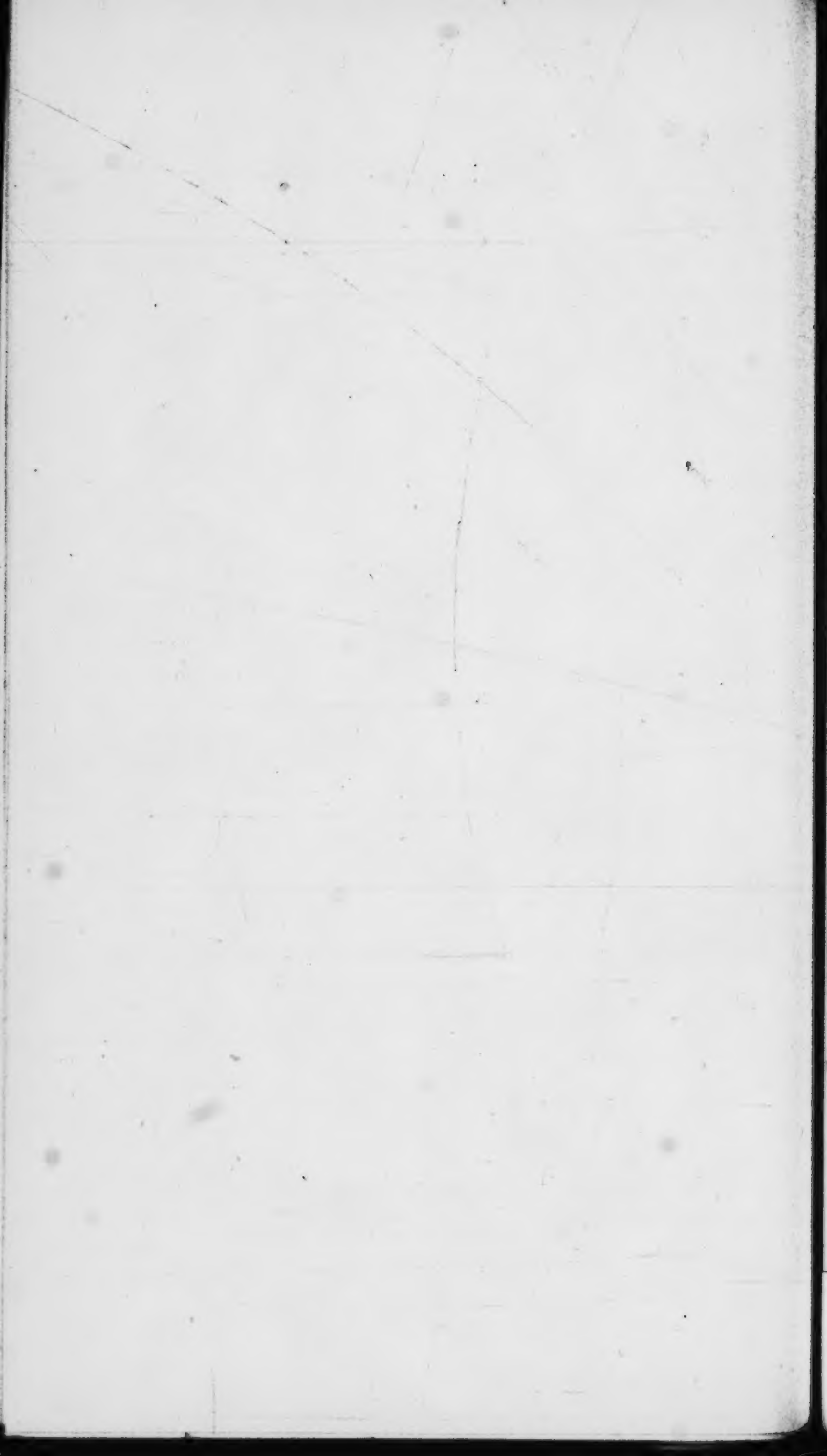


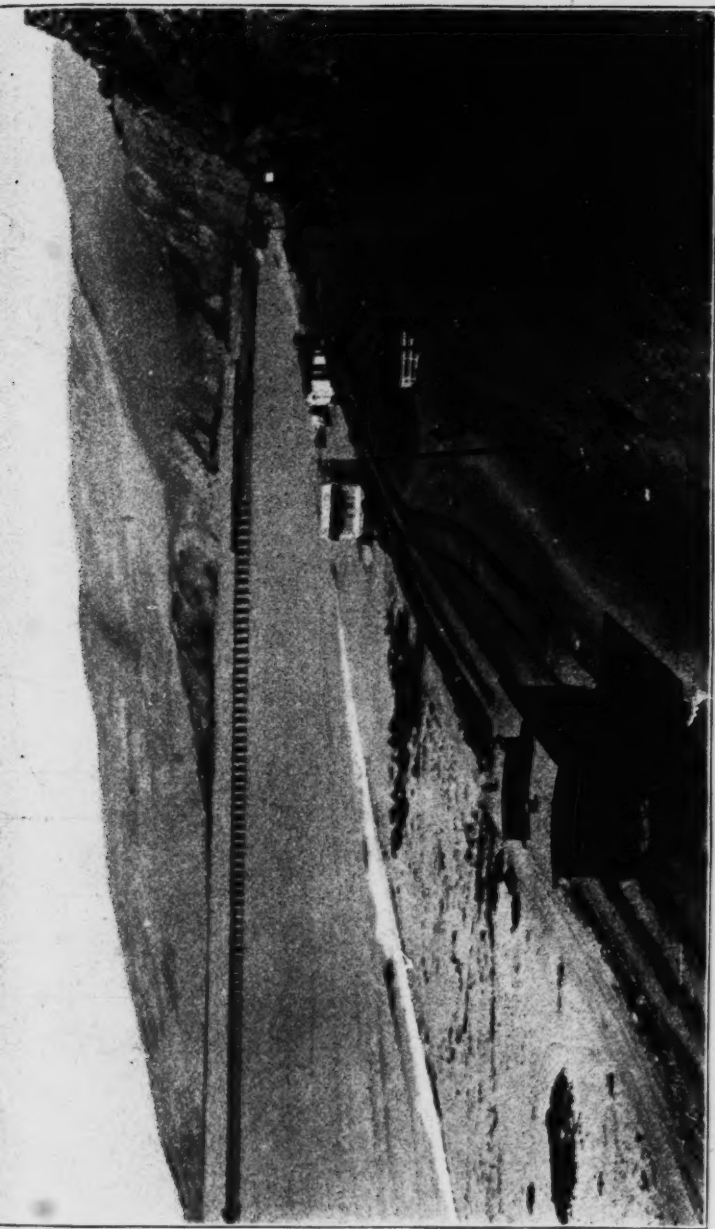
LEAGUE EXHIBIT NO. 2, STATION 2, LOOKING WEST.





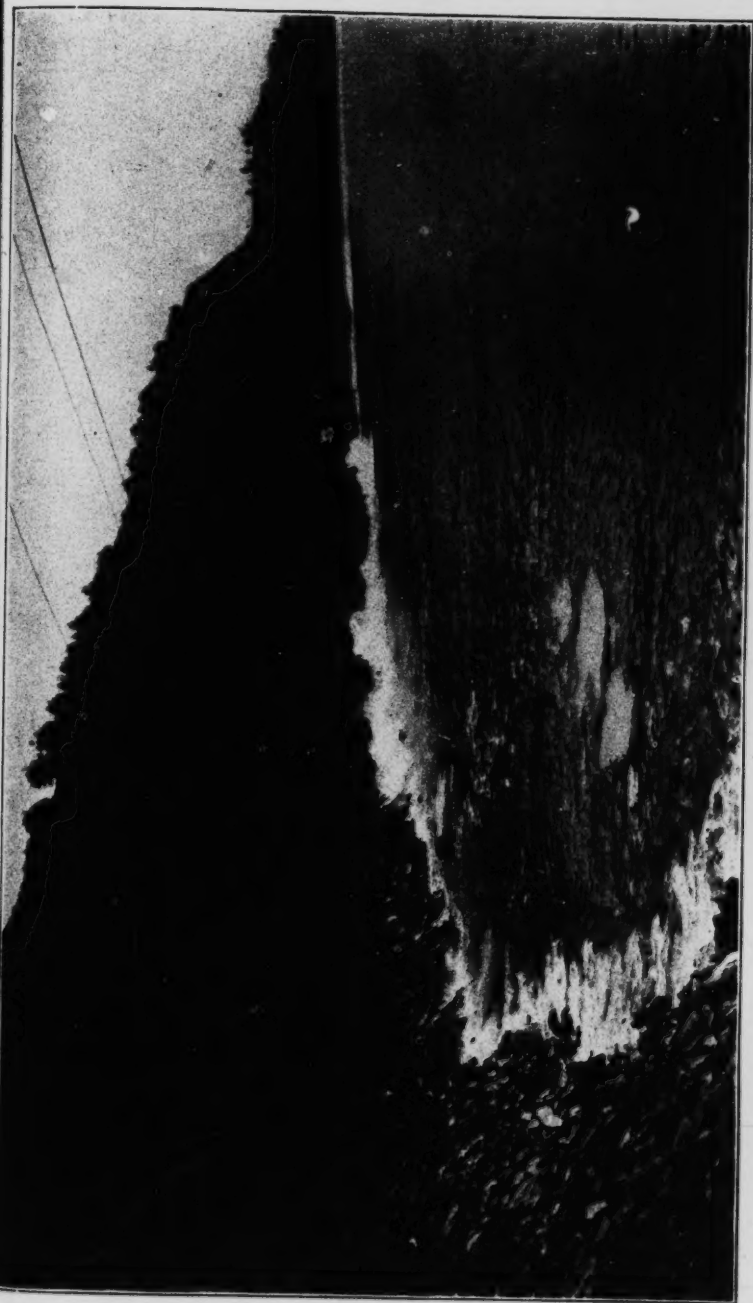
LEAGUE EXHIBIT NO. 2, STATION 3, LOOKING EAST.



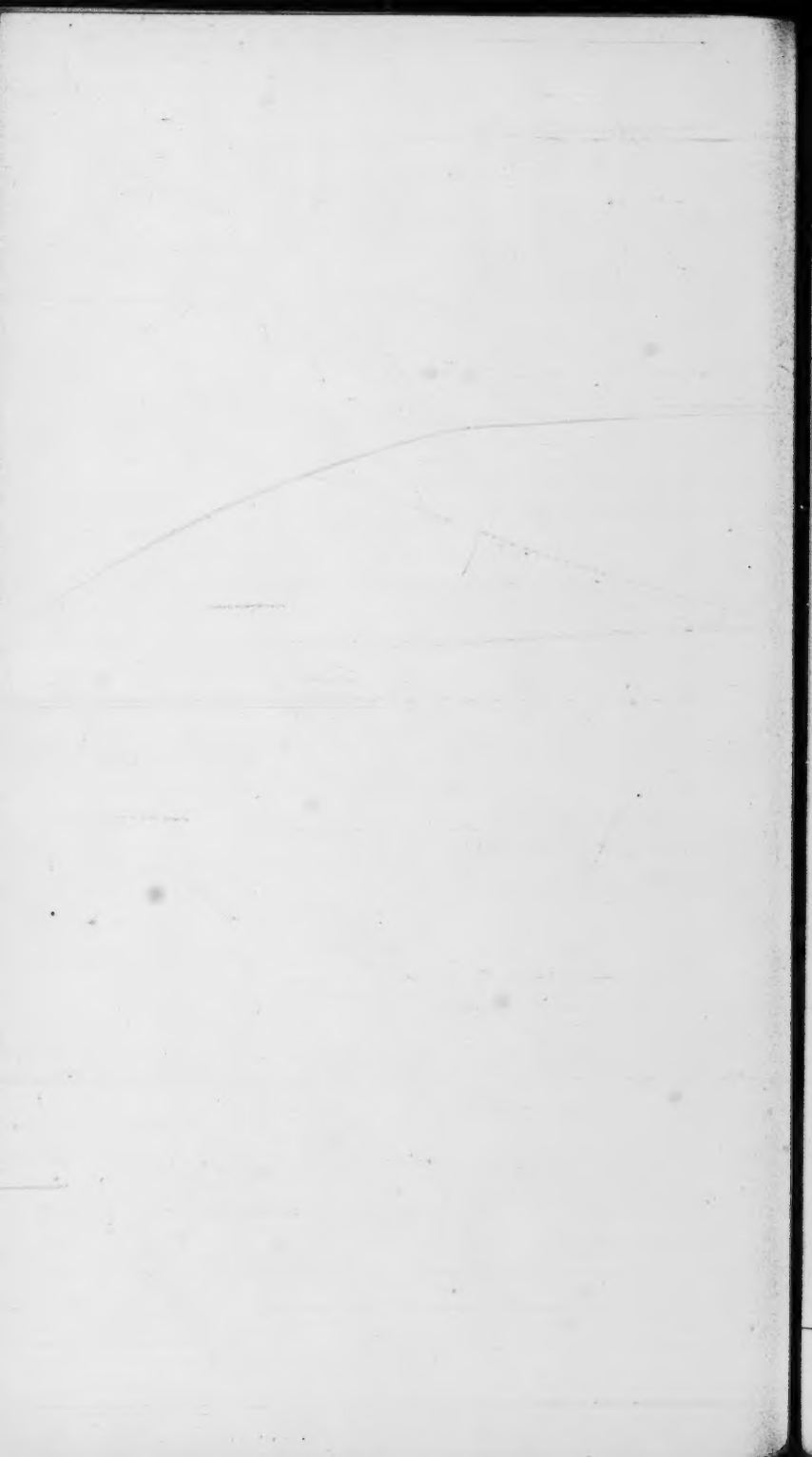


LEAGUE EXHIBIT NO. 2, STATION 3, LOOKING WEST.

٥٠

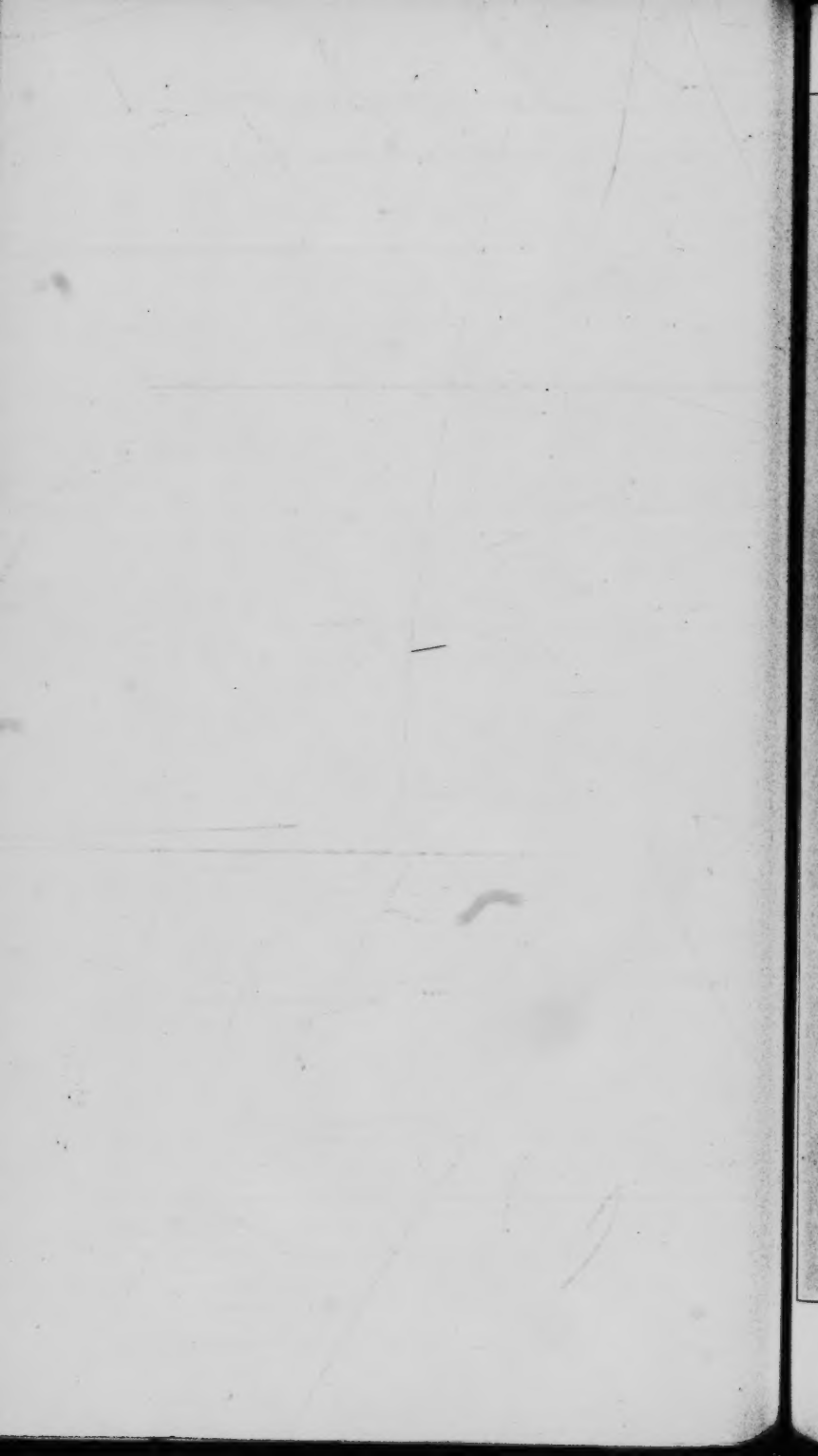


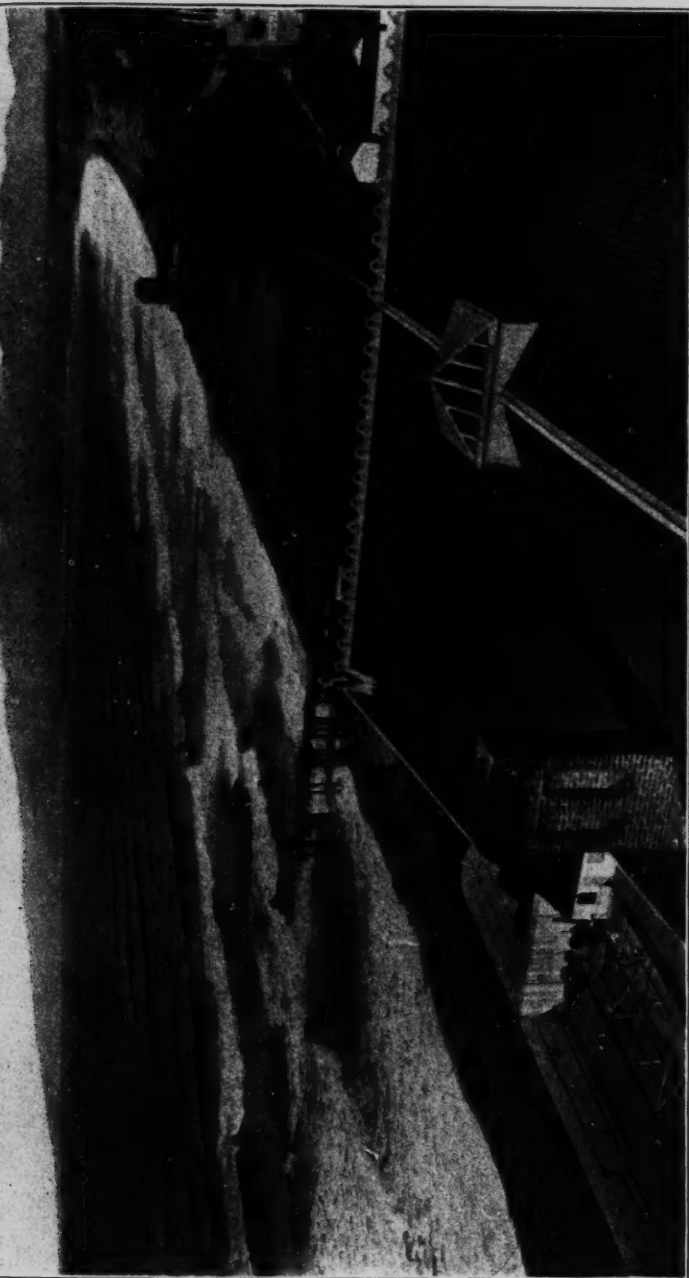
LEAGUE EXHIBIT NO. 2, STATION 4, LOOKING EAST.





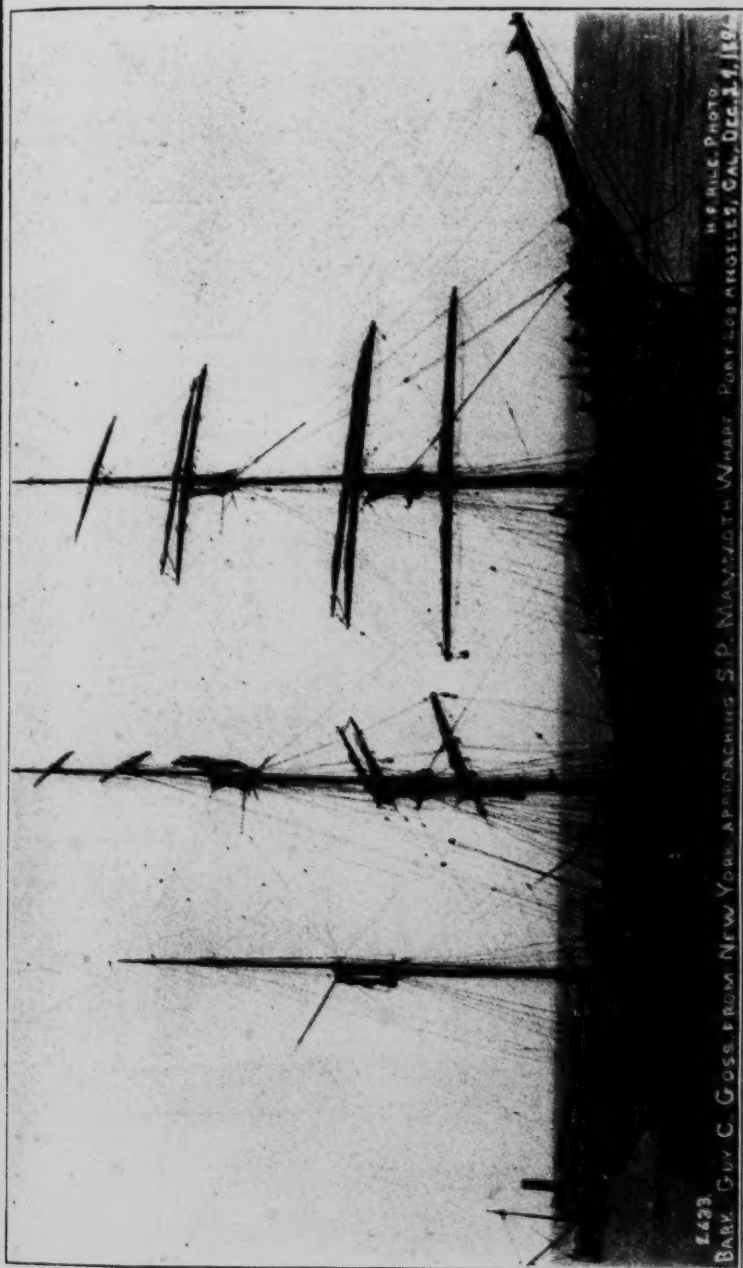
LEAGUE EXHIBIT NO. 2, STATION 4 LOOKING WEST.





SANTA MONICA BAY.





L423

BARK GUY C. GOSS, FROM NEW YORK, APPROACHING S. P. MARYSDOTH WHARF, PORT LOS ANGELES, CAL., DEC. 21, 1891.

H. P. RILEY, PHOTO.

and he will find where I received dynamite for the captain of the *Whitelaw*. I don't want to state anything but the truth, and if he wants the proof of it he will find it in his own books.

The CHAIRMAN. Does the Board understand now that the case is closed on both sides?

Mr. HOOD. It is closed on our side, as far as I know.

The CHAIRMAN. Gentlemen, the hearing is closed and the Board will adjourn, so far as this hearing is concerned, sine die.

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

APPENDIX G.

TONNAGE OF THE PORTS OF PORT LOS ANGELES AND SAN PEDRO.

The following tabulated statement of the tonnage (sail and steam) entering the two ports under consideration during the years 1893 to 1896, both inclusive, has been taken from the records of the custom-house at Los Angeles. It exhibits in considerable detail the class, number, and tonnage of vessels which have entered the ports during the period named, as well as the values of imports, so that the present approximate relative importance of each port may, to some extent at least, be determined:

PORT LOS ANGELES.

Year.	Vessels.		Tonnage.		Total.		Imports.
	Sail.	Steam.	Sail.	Steam.	Vessels.	Tonnage.	
1893	6	114	4,155	86,041	120	90,196	\$228,802
1894	7	181	4,930	163,221	188	168,201	450,612
1895	21	247	16,186	194,158	268	210,344	854,310
1896	18	165	22,416	178,261	183	200,677	538,713
Total	52	707	47,737	621,681	759	669,418	2,071,937

Total value of imports	\$2,071,937
Total value of merchandise consigned to Southern Pacific Company	1,644,868
Total value of all others	407,000

SAN PEDRO.

Year.	Vessels.		Tonnage.		Total.		Imports.
	Sail.	Steam.	Sail.	Steam.	Vessels.	Tonnage.	
1893	202	246	107,262	114,415	448	221,677	\$1,625,506
1894	192	201	65,949	70,290	393	136,239	1,416,113
1895	232	215	78,888	74,886	447	153,774	1,828,972
1896	143	180	41,601	70,004	323	111,605	1,758,356
Total	769	842	293,700	329,595	1,611	623,385	6,628,947

Number of vessels lightered:	
1893 (since May)	24
1894	12
1895	3
Total	39

Values of domestic merchandise imported in coastwise steamers not accounted for at either port.

J. G. WALKER,
Rear-Admiral, U. S. N., Chairman.

APPENDIX B OF MINORITY REPORT.

QUANTITIES IN PROPOSED PORT LOS ANGELES BREAKWATER.

[Depths taken to nearest one-half foot.]

SECTION 1.

[From west end of breakwater to point 500 feet from west end.]

Average depth	feet..	42½
Length of section	do..	500
Contents in section below plane of rest	cubic yards..	73, 230
Contents in section above plane of rest	do..	14, 250
Contents in section of superstructure	do..	7, 500

SECTION 2.

[From point 500 feet from west end to point 800 feet from west end.]

Length of section	feet..	300
Average depth	do..	44
Contents in section below plane of rest	cubic yards..	46, 791
Contents in section above plane of rest	do..	8, 550
Contents in section of superstructure	do..	4, 500

SECTION 3.

[From point 800 feet from west end to point 1,400 feet from west end.]

Length of section	feet..	600
Average depth	do..	45
Contents in section below plane of rest	cubic yards..	97, 458
Contents in section above plane of rest	do..	17, 100
Contents in section of superstructure	do..	9, 000

SECTION 4.

[From point 1,400 feet from west end to point 1,800 feet from west end.]

Length of section	feet..	400
Average depth	do..	48
Contents in section below plane of rest	cubic yards..	72, 960
Contents in section above plane of rest	do..	11, 400
Contents in section of superstructure	do..	6, 000

SECTION 5.

[From point 1,800 feet from west end to point 2,300 feet from west end.]

Length of section	feet..	500
Average depth	do..	49½
Contents in section below plane of rest	cubic yards..	96, 360
Contents in section above plane of rest	do..	14, 250
Contents in section of superstructure	do..	7, 500

SECTION 6.

[From point 2,300 feet from west end to angle of breakwater.]

Length of section	feet..	200
Average depth	do..	50
Contents of section below plane of rest	cubic yards..	39, 328
Contents of section above plane of rest	do..	5, 700
Contents of section of superstructure	do..	3, 000

SECTION 7.

[From angle to 1,000 feet east of angle.]

Length of section.....	feet..	1,000
Average depth.....	do..	50½
Contents in section below plane of rest.....	cubic yards..	199,710
Contents in section above plane of rest.....	do..	28,500
Contents in section of superstructure.....	do..	15,000

SECTION 8.

[From point 1,000 feet east of angle to point 1,500 feet east of angle.]

Length of section.....	feet..	500
Average depth.....	do..	51
Contents in section below plane of rest.....	cubic yards..	101,615
Contents in section above plane of rest.....	do..	14,250
Contents in section of superstructure.....	do..	7,500

SECTION 9.

[From point 1,500 feet east of angle to point 4,100 feet east of angle.]

Length of section.....	feet..	2,500
Average depth.....	do..	50½
Contents in section below plane of rest.....	cubic yards..	499,275
Contents in section above plane of rest.....	do..	71,250
Contents in section of superstructure.....	do..	37,500

QUANTITIES AND PRICES FOR 6,500 FEET IN LENGTH AT PORT LOS ANGELES.

[Quantities measured in the work.]

1,226,637 cubic yards below the plane of rest, at \$1.20.....	\$1,471,954
185,250 cubic yards above the plane of rest, at \$1.50.....	277,875
97,500 cubic yards of superstructure, at \$3.....	292,500
Concrete ends to the breakwater.....	12,800
	2,055,129
10 per cent, engineering and contingencies.....	205,512
	2,260,641
Royalty, 10 cents per cubic yard in quarries.....	108,832
Total.....	2,369,473
Appropriation.....	2,900,000
Estimate.....	2,369,473
Balance.....	530,527

The foregoing prices are believed to be fully as high as the present cost of similar work justifies.

The balance of the fund unexpended provides for any subsidence of the breakwater, and also for some extension of it if deemed desirable.

SPECIAL EXHIBITS FILED WITH BOARD DURING PUBLIC HEARINGS.

SAN FRANCISCO, January 28, 1897.

GENTLEMEN: Following the suggestion of members of your Board, that we illustrate more fully the proposition of filling out from the shore at Port Los Angeles for obtaining area for lumber yards, mills, warehouses etc., and for obtaining a bulkhead line from which lumber firms and others can project short piers for light-draft vessels, giving facilities for any method of unloading lumber and other cargoes that may be suitable and preferred, herewith attached please find detail sheets, showing estimate details which can readily be applied to any length of area proposed to be reclaimed and filled in; also blue prints illustrative of the subject.

I have intentionally used rather high prices, and have considered the rock used to be granite transported by rail, so that it may safely be said that such improvements can be carried to completion for less than the figures given. The whole is illustrative of the subject rather than specific. I have given figures on two propositions—one for a bulkhead in general on the 2-fathom line; one for a bulkhead in general on the 3-fathom line. Although the latter is the more costly, I think it would probably be wise to adopt it, but possibly not. It is quite possible an investigation prior to actual construction would show that a concrete wall would be expedient in place of a rock bulkhead. These are matters of detail to be determined on at the time the work is to be done.

It will be noticed that I have taken section A in about as unfavorable a place as there is as affecting the cost of the work. Also that a light grade of 1 per cent has been used in descending from the present railroad grade to the wharf level, so that any portion of the filled area would be suitable for buildings, etc., while it is evident that a steeper descent to the wharf level would cheapen the work.

The plan of construction I have assumed is to build first the east and west protecting rock bulkheads to a height of 4 feet above ordinary high tide, from a temporary trestle, and to build the front protecting rock bulkhead to the same height from the 48-foot front timber bulkhead, with temporary track thereon before planking and finishing this front timber bulkhead. Then to fill in the space so inclosed with earth by steam shovel and train work, plowing off by side plow in the ordinary manner, with material obtained from the hill slopes to westward of the engine stalls at Port Los Angeles, this material to come from land now owned by Messrs. Jones and Baker, or possibly from farther west if Messrs. Jones and Baker should object, which is not likely, and the excavation itself making available ground for sundry uses, this ground being excavated to the level of the railroad grade. This land is of little value in its present condition.

Sheet D of the detail sheets shows the cost of 3,000 linear feet of reclaimed area, etc., to the 2-fathom line, this being indicated in position on print 4145 A, and in profile on print 4145 C, and the details of sheet D being furnished by sheets E and F.

Sheet A of the detail sheets shows the cost of 3,000 feet of reclaimed area, etc., to the 3-fathom line, this being indicated in position on print No. 4145 A and in profile on print No. 4145 B. All prints attached.

Evidently a longer extent of foreshore reclaimed at one time would be somewhat cheaper per unit of area.

As to the height of wharves, assumed at 8 feet above ordinary high water, or 14 feet above mean low water, this might be varied after study of the exact character of vessels that would be expected. It is evidently high enough above the water for a wharf for deep-sea ships, after the construction of a breakwater.

I have made no estimates of this character for utilizing San Pedro outer harbor for reasons quite evident from consideration of the chart, foreshore, and character of available filling material.

Yours, respectfully,

WILLIAM HOOD,
Chief Engineer Southern Pacific Company.

JOHN G. WALKER, Rear-Admiral, U. S. N., Chairman,
AUGUSTUS F. RODGERS, Assistant, United States Coast Survey,
WILLIAM H. BURR, Esq.,
RICHARD P. MORGAN, Esq.,
GEORGE S. MORISON, Esq.,
Board for Locating a Deep-Water Harbor in Southern California.

SHEET A.

Estimate of cost of filled area to 3 fathoms +, as shown on blue print 4145 A, per section A blue print 4145 B, 3,000 feet long up and down the coast, measured along bulkhead line, 114 acres.

3,000 linear feet timber bulkhead (sheet A) at \$15.29	\$45,870.00
3,000 linear feet earth fill and rock bulkhead (sheet C 1), at \$286.23....	858,690.00
Rock protection on east end (sheet C 2)	78,983.76
Rock protection on west end (sheet C 2).....	78,983.76
Total, 114 acres	1,062,527.52
Or \$9,320 per acre.	

SHEET B.

[Per blue print No. 4145 A and blue print section A print No. 4145 B.]

Timber bulkhead, 48 feet wide, in front of rock bulkhead.

Piles, 12-foot centers in all directions, for 12 feet length, measured along bulkhead up and down the coast.

4 creosoted piles, each 48 feet, 192 linear feet, at 36.5 cents	\$70.08
12 linear feet redwood mudsill, 12 by 12, 144 feet, B. M., at \$14.50.....	2.09
27 feet B. M. 3-inch redwood plank, at \$14.50	.39
4 Oregon pine caps, 12 feet by 12 by 12 inches, 576 feet, B. M., at \$12.50.....	7.20
1 Oregon pine string, 12 feet by 10 by 12 inches, 120 feet, B. M., at \$12.50.....	1.50
8 Oregon pine stringers, 50 feet by 4 by 12 inches, 1,600 feet, B. M., at \$12.50..	20.00
44 Oregon pine plank, 12 feet by 3 by 12 inches, 1,584 feet, B. M., at \$12.50...	19.80
Nails, spikes, shop irons, 4,050 feet, B. M., at \$4.....	16.20
Labor, superstructure, 4,050 feet, B. M., at \$7.50.....	30.38
Pile driving, 4 piles, net 44 feet, 176 linear feet, at 9 cents.....	15.84
Total for 12 feet in length	183.48
Or per foot run, measured up and down the coast along the bulkhead line ...	15.29

SHEET C.

- Cost per foot run of earth fill and rock bulkhead, per blue print No. 4145 A and blue print, section A, print No. 4145 B (foot run measured up and down the coast along bulkhead line):

1,670 cubic yards earth, at \$0.12	\$200.40
49.9 cubic yards rock bulkhead and slope, at \$1.72	85.83
Total, per foot run	286.23

- Protection at east or west end of filled area, using same section as for rock bulkhead:

42,758 cubic yards rock in place, at \$1.72.....	\$73,543.76
1,600 linear feet temporary trestle, after deducting top work, re-covered, at \$3.40.....	5,440.00
Total east or west end protection.....	78,983.76

- Area available, assuming filled area 3,000 feet long up and down the coast along bulkhead line, and 1,657 feet wide, including the 48-foot timber bulkhead, is 114+ acres.

SHEET D.

Estimated cost of filled area to 2 fathoms +, as shown on blue print No. 4145 A, per section A, blue print No. 4145 C, 3,000 feet long upon and down the coast, measured along bulkhead line, 77.6 acres.

3,000 linear feet timber bulkhead (sheet E), at \$14.53.....	\$43,590.00
3,000 linear feet earth fill and rock bulkhead (sheet F 1), at \$187.79.....	563,370.00
Rock protection on east end (sheet F 2).....	38,982.20
Rock protection on west end (sheet F 2)	38,982.20
Total 77.6 acres	684,924.40
Or \$8,826 per acre.	

DEEP-WATER HARBOR.

SHEET E.

[Blue print No. 4145 A, and blue print section A, print 4145C.]

Timber bulkhead 48 feet wide in front of rock bulkhead.

Piles, 12-foot centers in all directions.

For 12 feet in length, measured up and down the coast.

4 creos. piles, each 43 feet, 172 linear feet, at 36.5 cents.....	\$62.78
12 linear feet redwood mudsill, 12 by 12 inches, 144 feet, B. M., at \$14.50....	2.09
27 feet, B. M. 3-inch redwood plank, at \$14.50.....	.39
4 Oregon pine caps, 12 by 12 by 12 inches, 576 feet, B. M., at \$12.50.....	7.20
1 Oregon pine string, 12 by 10 by 12 inches, 120 feet, B. M., at \$12.50.....	1.50
8 Oregon pine stringers, 50 feet by 4 by 12 inches, 1,600 feet, B. M., at \$12.50..	20.00
44 Oregon pine plank, 12 feet by 3 by 12 inches, 1,584 feet, B. M., at \$12.50 ..	19.80
Nails, spikes, shop irons, 4,050 feet, B. M., at \$4.....	16.20
Labor, superstructure, 4,050 feet, B. M., at \$7.50.....	30.38
Pile driving, 4 piles, net 39 feet, 156 linear feet, at 9 cents.....	14.04
Total, for 12 feet in length.....	174.38
or per foot run, measured up and down the coast along the bulkhead line ..	14.53

SHEET F.

1. Cost per foot run of earth fill and rock bulkhead, per blue print 4145 A and blue print section A, print 4145 C. (Foot run measured up and down the coast along bulkhead line):

1,069 cubic yards earth, at \$0.12.....	\$128.28
34.6 cubic yards rock bulkhead and slope, at \$1.72.....	59.51

Total per foot run 187.79

2. Protection at east or west end of filled area, using same section as for rock bulkhead:

20,860 cubic yards rock in place, at \$1.72.....	\$35,879.20
1,070 linear feet temporary trestle after deducting topwork re-covered, at \$2.90.....	3,103.00

Total east or west end protection..... 38,982.20

3. Area available, assuming filled area 3,000 feet long up and down the coast and 1,127 feet wide, including the 48-foot timber bulkhead, is 77.6+ acres.

SAN FRANCISCO, January 27, 1897.

GENTLEMEN: Attached please find revised blue print No. 4594, and copies of letters pertaining thereto. This is done at the suggestion of members of your Board.

Yours, respectfully,

WILLIAM HOOD,

Chief Engineer Southern Pacific Company.

JOHN G. WALKER, Rear-Admiral, U. S. N., Chairman,

AUGUSTUS F. RODGERS, Assistant, U. S. Coast Survey,

WILLIAM H. BURR, Esq.,

RICHARD P. MORGAN, Esq.,

GEORGE S. MORISON, Esq.,

Board for Locating a Deep-Water Harbor in Southern California.

LOS ANGELES, February 13, 1896.

DEAR SIR: I inclose herewith a memorandum obtained for me by Mr. Holabird from Mr. Wincup. I told him I wanted it in connection with the movements of the Terminal Road in trying to get a breakwater at San Pedro; that the Terminal Railway Company claimed to have large landed interests at San Pedro, when, as a matter of fact, I understood they had only about 42 acres.

This will give you an idea of what the Terminal Land Company is.

Yours, respectfully,

J. A. MUIR, Superintendent,

Mr. H. E. HUNTINGTON,

Assistant to President Southern Pacific Company,

23 Broad street, New York City.

33' 03'

32'

31'

U. S. COAST AND GEODETIC SURVEY

41452

T. C. MENDENHALL SUPERINTENDENT

DETAILED HYDROGRAPHIC SURVEY

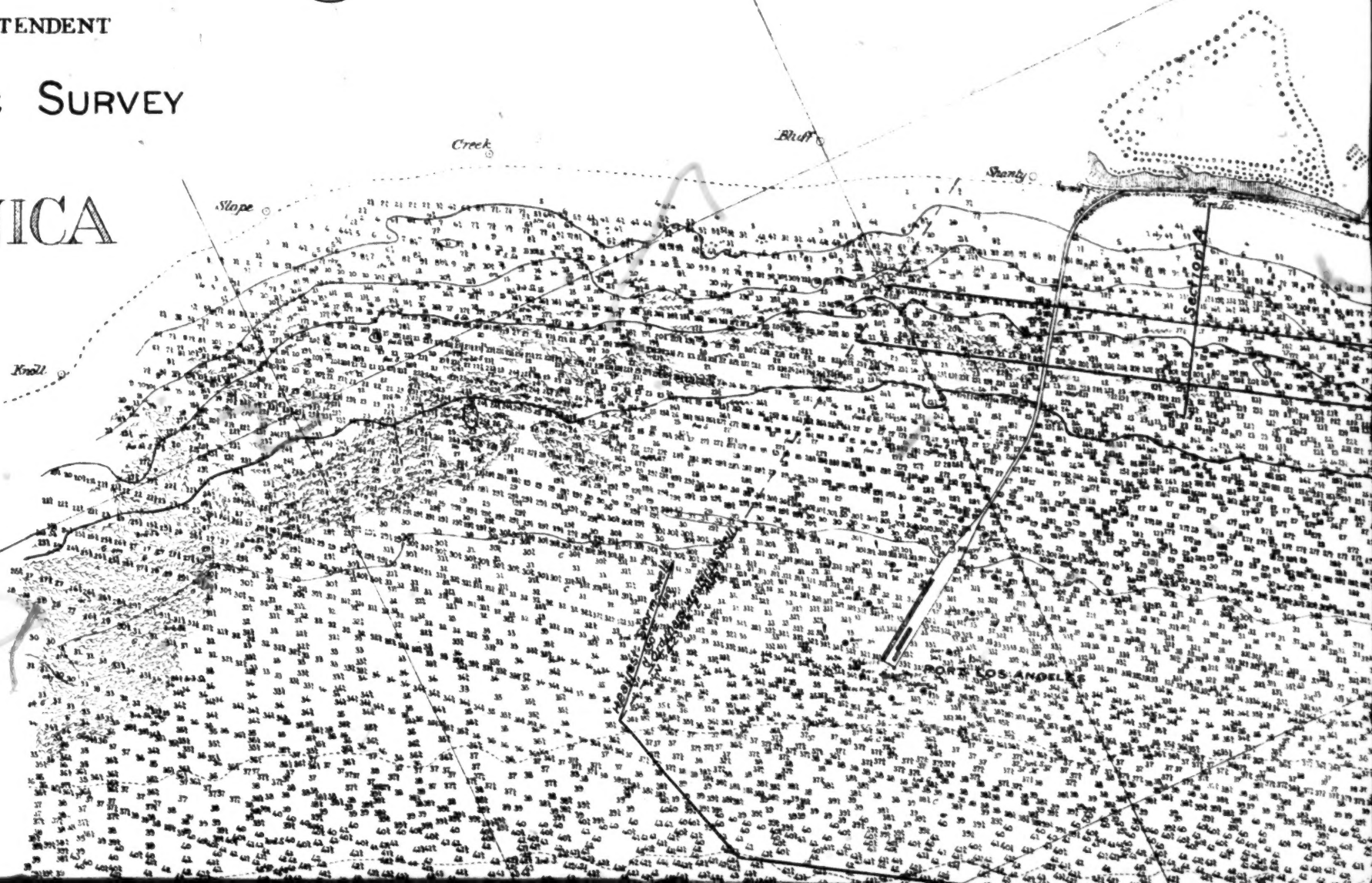
OF

SANTA MONICA

CALIFORNIA

1893

Scale $\frac{1}{333}$



32'

31'

02'

118° 30'



Bell, Lights, and Buoys

The Southern Pacific Company has placed a fog-bell on the outer end of the wharf, a red light on the NW corner, and a green light on the SW corner.

The dots shown thus • are mooring buoys, laid

Tides

The high and low waters were observed from January 31st to March 20th. Readings were also made every ten minutes while soundings were taken. The mean of the first 32 lower low waters is 5.04, and for convenience 5⁰⁰ was adopted as the plane of reference.

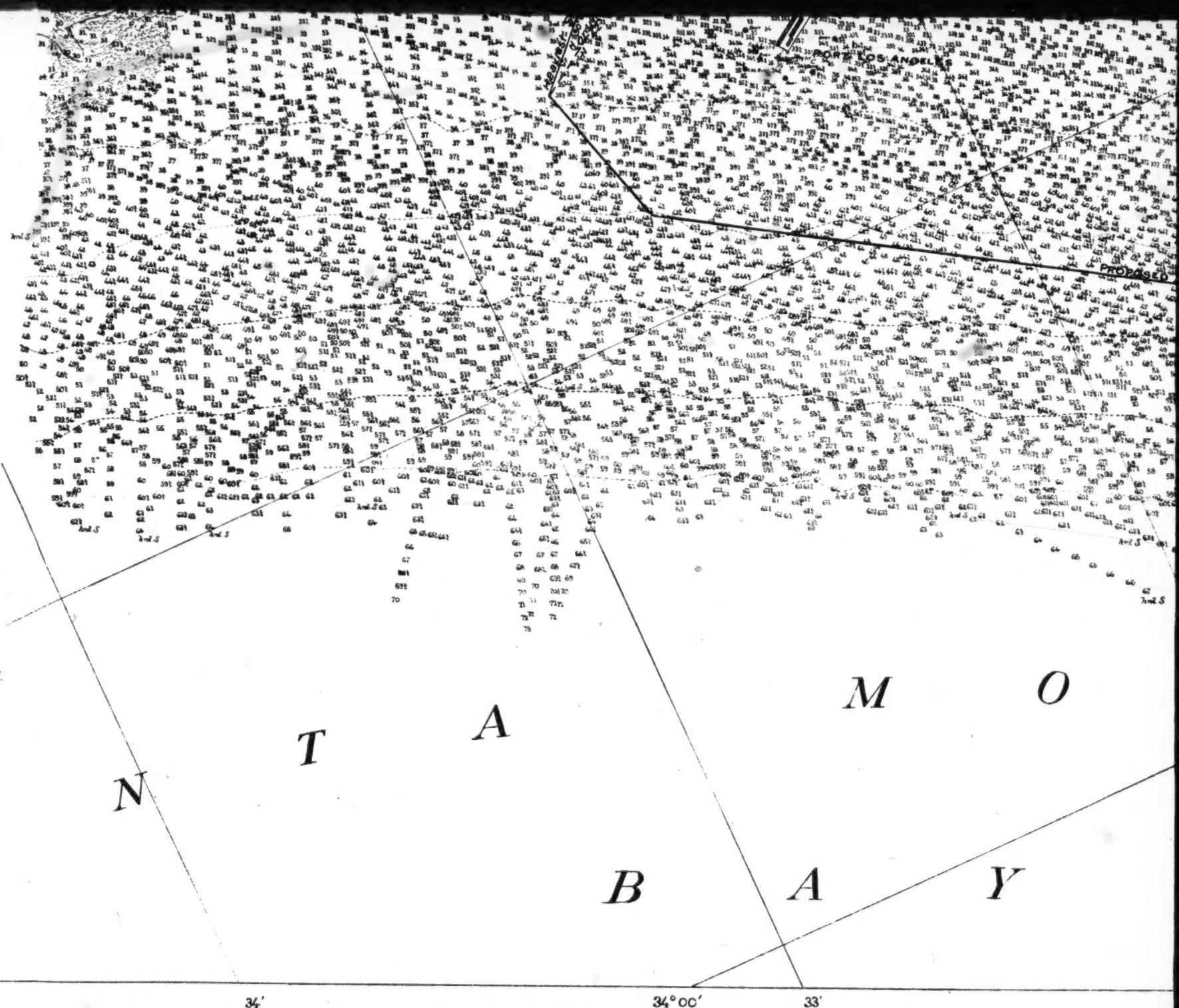
Mean of Lower Low Waters (entire series)	5 13
Higher High	10 49
Rise and Fall	5 36
Highest tide observed, February 1 st	12 12
Lowest " " February 16 th	3 30
Extreme range of tide	8 22
Extreme range in one day	8 16

Soundings

Soundings were recorded and reduced to the nearest half foot, and the depth of water is shown in feet at the mean (nearly) of the lower low waters of the 24 hours, the plane of reference. The curves of equal depth are marked for every fathom, as follows:

1 fathom curve in green, thus	_____
2 " " " red " " " " " "	_____
3 " " " " blue " " " " " "	_____
4 " " " " purple " " " " " "	_____
5 " " " " brown " " " " " "	_____
6 " " " broken green " " " " " "	_____
7 " " " " red " " " " " "	_____
8 " " " " blue " " " " " "	_____
9 " " " " purple " " " " " "	_____
10 " " " " brown " " " " " "	_____

Kelp is marked in brown ink thus  and the limits of each field have been fairly well determined.

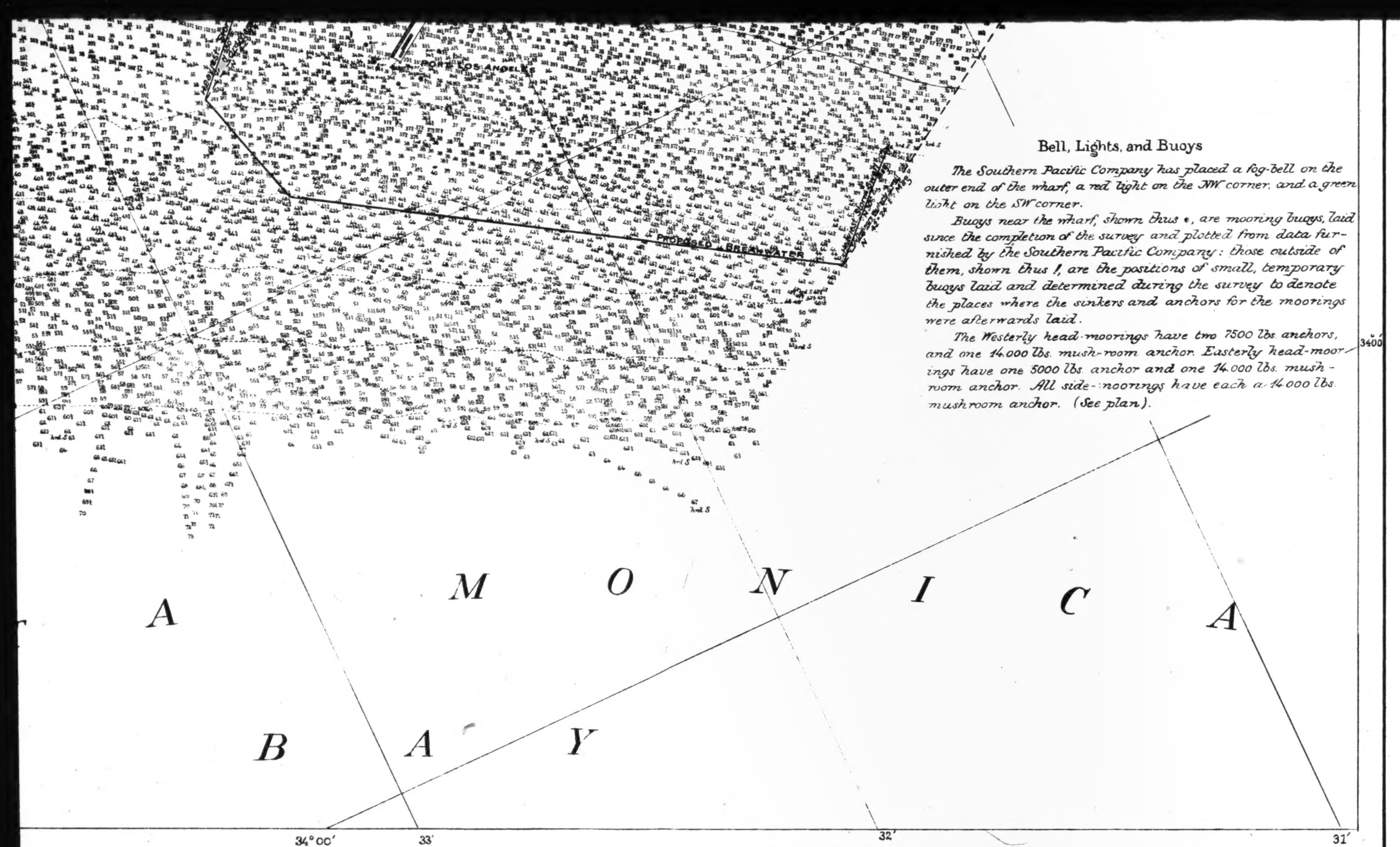


118° 35'

34'

34° 00'

33'



Bell, Lights, and Buoys

The Southern Pacific Company has placed a fog-bell on the outer end of the wharf, a red light on the NW corner, and a green light on the SW corner.

Buoys near the wharf, shown thus , are mooring buoys, laid since the completion of the survey and plotted from data furnished by the Southern Pacific Company: those outside of them, shown thus , are the positions of small, temporary buoys laid and determined during the survey to denote the places where the sinkers and anchors for the moorings were afterwards laid.

The Westerly head-moorings have two 7500 lbs. anchors, and one 14,000 lbs. mush-room anchor. Easterly head-moorings have one 3000 lbs. anchor and one 14,000 lbs. mush-room anchor. All side-moorings have each a 14,000 lbs. mush-room anchor. (See plan).

3400'

Profile on Section "A" of Blueprint N^o 4145 @, with bulkhead line at three fathoms.

4145 b

1670 cubic yards Earth fill per foot run.

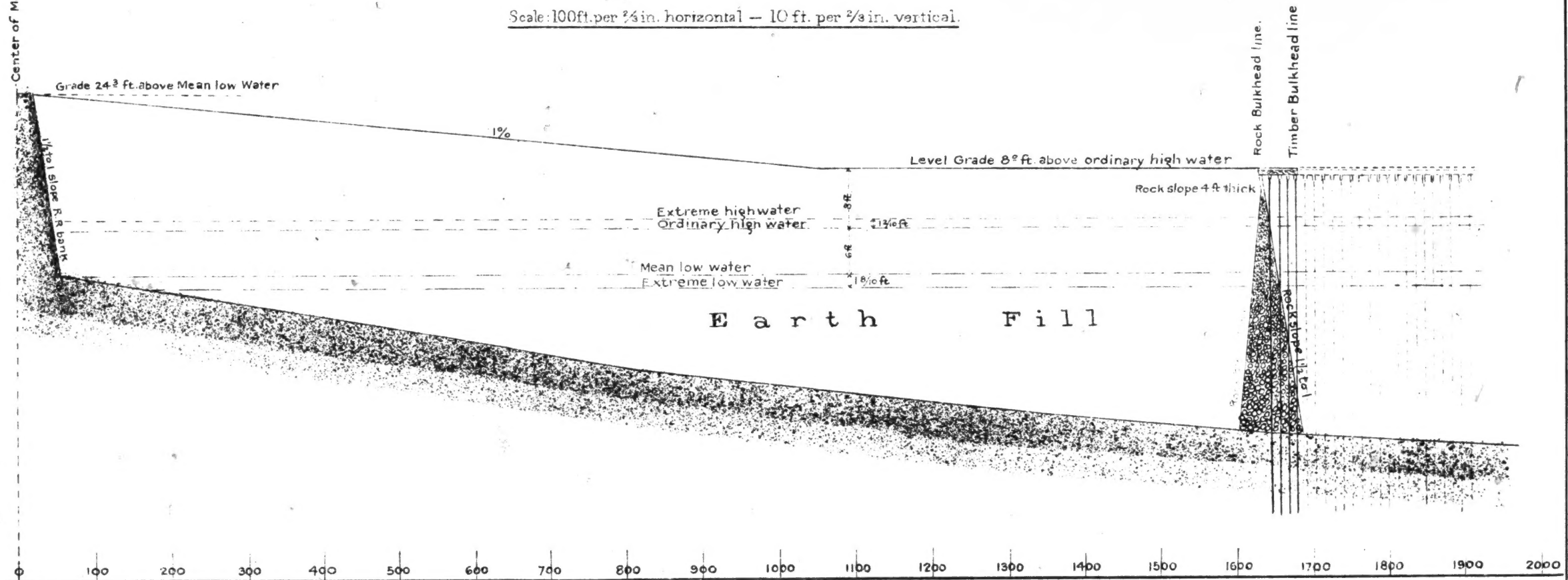
49 $\frac{3}{10}$ cubic yards rock Bulkhead and Slope per foot run.

Note: Per foot run is measured up and down the coast, along bulkhead line.

42,758 cubic yards rock end protection at each end of such area as shall be first reclaimed and filled, - and for subsequent reclamation and filling
42,758 cubic yards at one end only of such subsequently reclaimed area.

Dotted lines indicate wharves of suitable widths and lengths per requirements of local users, and projecting from timber bulkhead at suitable intervals.

Scale: 100 ft. per $\frac{3}{4}$ in. horizontal - 10 ft. per $\frac{2}{3}$ in. vertical.



Profile on Section "A" of Blueprint N^o 4145 a, with bulkhead line at two fathoms.

1069 cubic yards Earth fill per foot run.

34 $\frac{1}{10}$ cubic yards rock Bulkhead and Slope per foot run.

Note: Per foot run is measured up and down the coast, along bulkhead line.

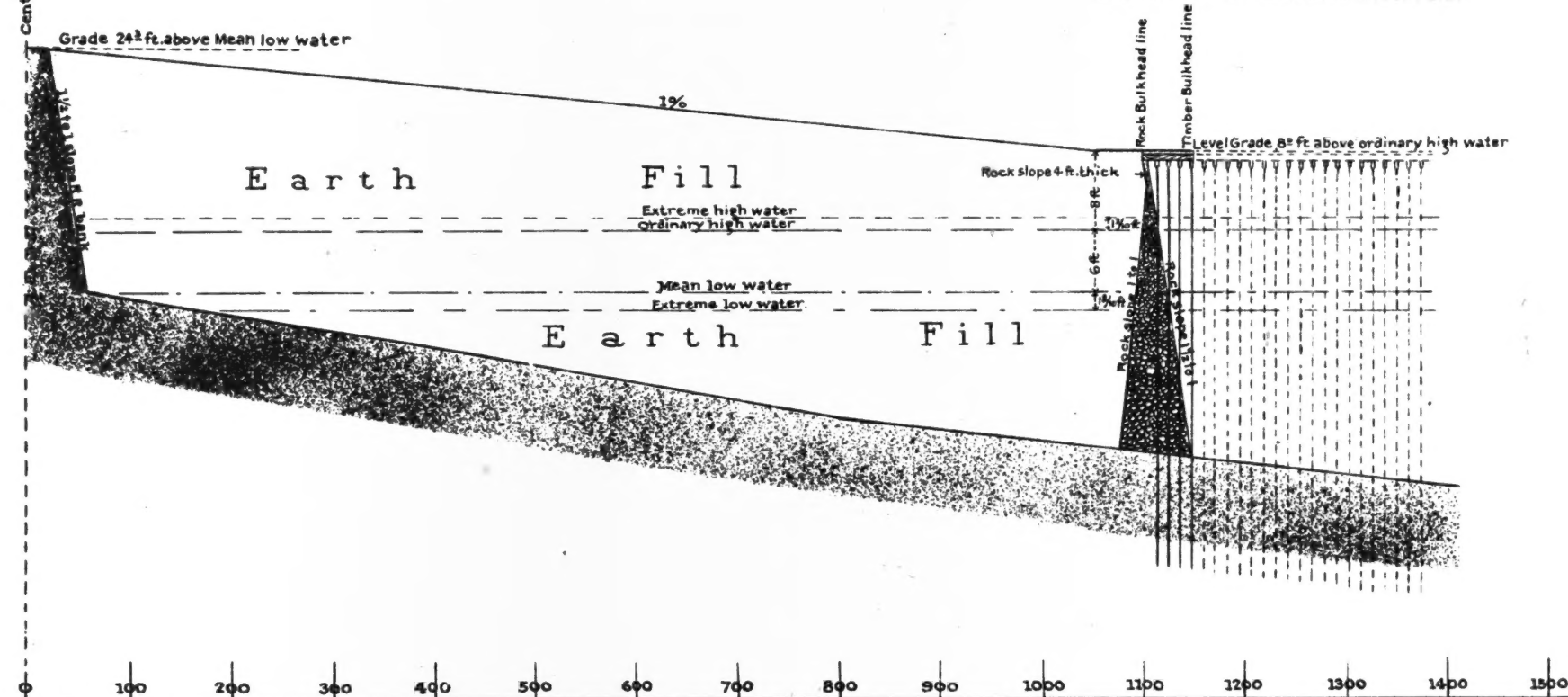
20,860 cubic yards rock end protection at each end of such area as shall be first reclaimed and filled, - and for subsequent reclamation and filling 20,860 cubic yards at one end only of such subsequently reclaimed area.

Scale: 100 ft. per $\frac{2}{3}$ in horizontal - 10 ft per $\frac{2}{3}$ in. vertical.

Dotted lines indicate wharves of suitable widths and lengths per requirements of local users, and projecting from timber Bulkhead at suitable intervals.

Center of Main line R. R. Track

4145 a

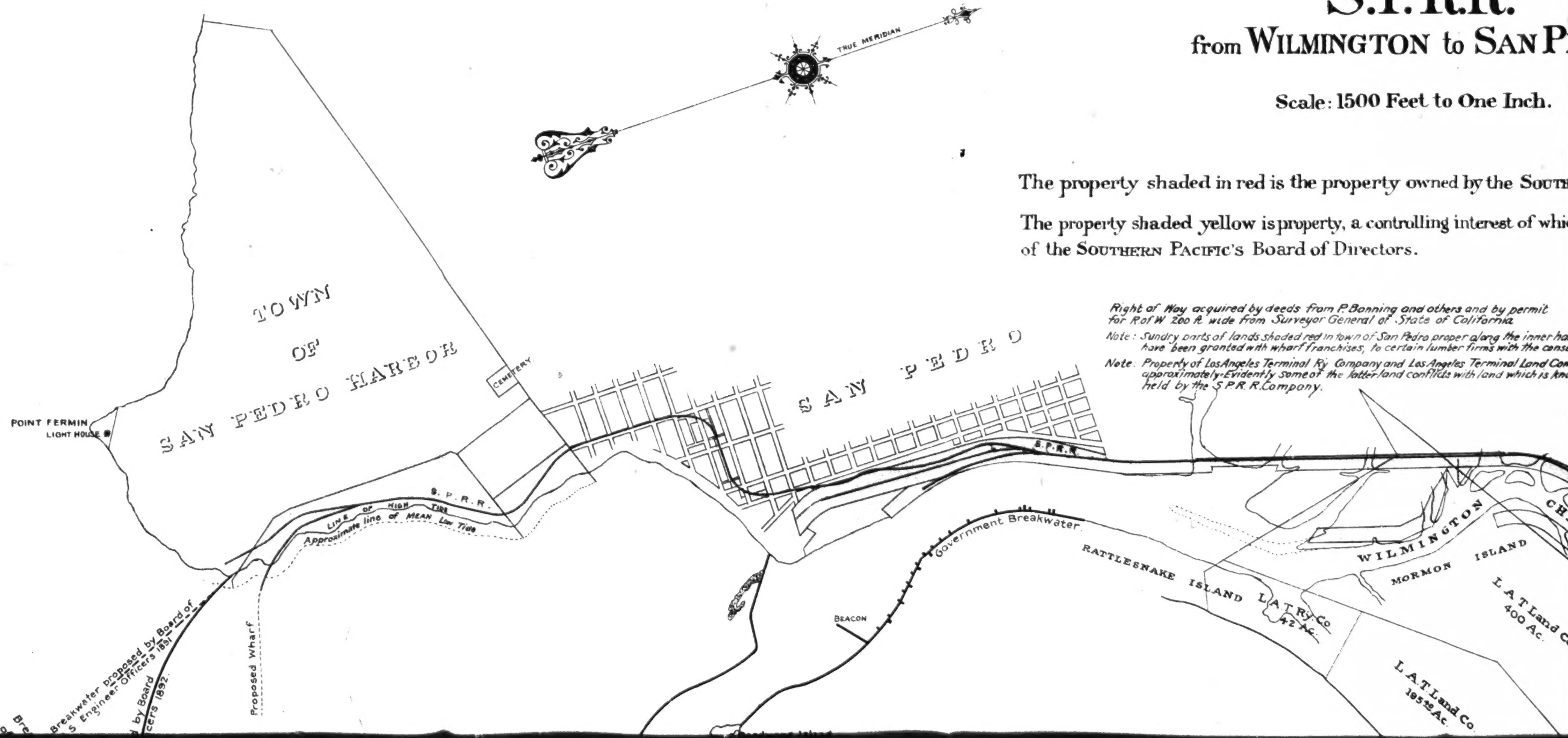


PACIFIC OCEAN

MAP OF S.P.R.R. from WILMINGTON to SAN PEDRO

Scale: 1500 Feet to One Inch.

The property shaded in red is the property owned by the Southern Pacific Company.
The property shaded yellow is property, a controlling interest of which is held by the Southern Pacific's Board of Directors.



Right of Way acquired by deeds from P. Banning and others and by permit for R.O.W. 200 ft. wide from Surveyor General of State of California.
Note: Sundry parts of lands shaded red in town of San Pedro proper along the inner harbor have been granted with wharf franchises, to certain lumber firms with the consent of the S.P.R.R. Company.
Note: Property of Los Angeles Terminal Ry. Company and Los Angeles Terminal Land Company approximately. Evidently some of the latter land conflicts with land which is now held by the S.P.R.R. Company.

MAP OF S.P.R.R. from WILMINGTON to SAN PEDRO.

Scale: 1500 Feet to One Inch.

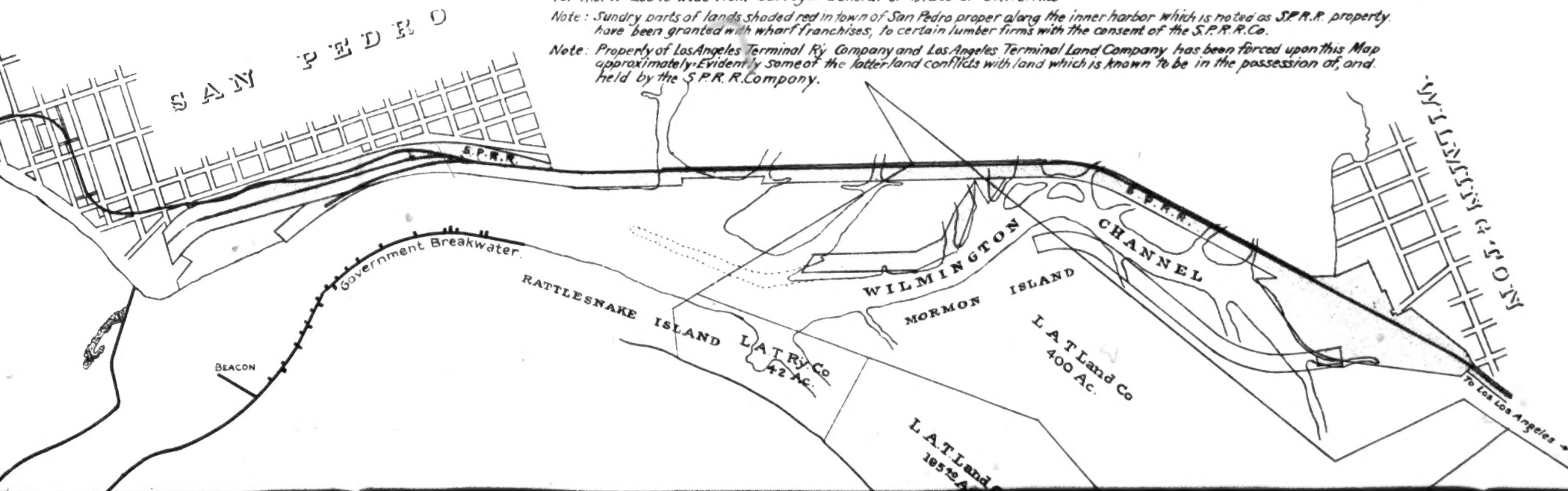
The property shaded in red is the property owned by the SOUTHERN PACIFIC R.R. CO.

The property shaded yellow is property, a controlling interest of which is owned by individual members of the SOUTHERN PACIFIC'S Board of Directors.

Right of Way acquired by deeds from P. Banning and others and by permit for R. of W. 200 ft. wide from Surveyor General of State of California.

Note: Sundry parts of lands shaded red in town of San Pedro proper along the inner harbor which is noted as S.P.R.R. property have been granted with wharf franchises, to certain lumber firms with the consent of the S.P.R.R. Co.

Note: Property of Los Angeles Terminal Ry. Company and Los Angeles Terminal Land Company has been forced upon this Map approximately. Evidently some of the latter land conflicts with land which is known to be in the possession of, and held by the S.P.R.R. Company.



POINT FERMIN
LIGHT HOUSE

SAN PEDRO

S. P. R. R.

LINE OF HIGH TIDE
Approximate line of MEAN LOW TIDE

Proposed Wharf

Breakwater proposed by Board of
U.S. Engineer Officers 1891
Breakwater proposed by Board
of U.S. Engineer Officers 1892
Breakwater proposed by Board
of U.S. Engineer Officers 1891

BEACON

Deadmans Island

SAN PEDRO BAY

Government Breakwater

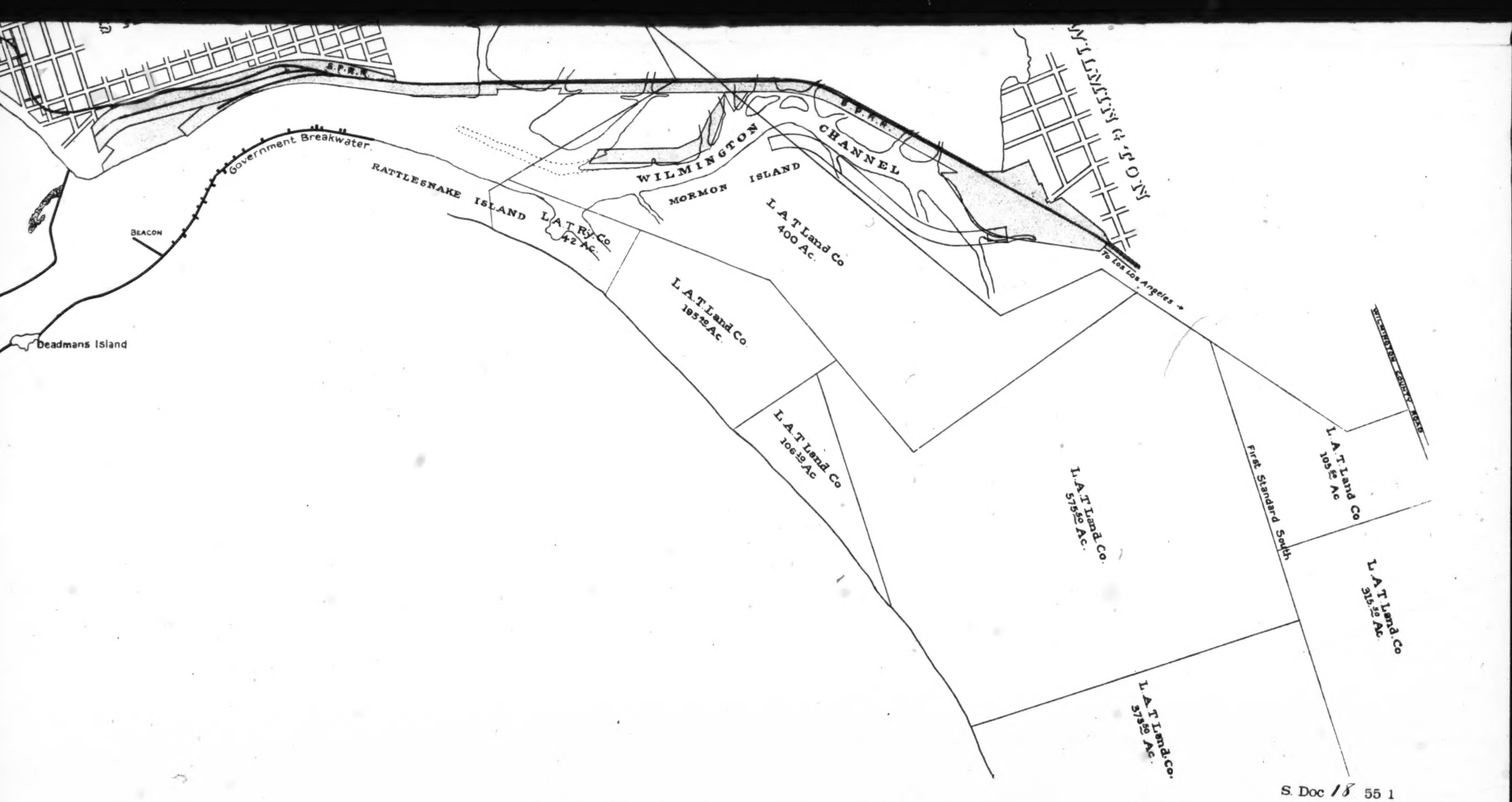
RATTLESNAKE ISLAND

LATRY Co
42 AC.

WILMINGTON ISLAND
MORMON ISLAND

L.A. Land Co
18522 Ac.

L.A. 106



DEEP-WATER HARBOR.

209

LOS ANGELES, CAL., February 11, 1896.

Los Angeles Terminal Land Company, a corporation organized under the laws of the State of California June 29, 1891.

[Capital \$300,000.]

Stockholders.	Shares.	Amount.
Director R. C. Kerens	1	\$100
Director Chas. Green	1	100
Director Chas. H. Bailey	1	100
Director T. B. Burnett	1	100
T. B. Burnett, trustee	2,991	299,100
Director William Wincup	1	100
Geo. E. Wright	1	100
Jas. H. Barham	1	100
Director T. L. Burnett	1	100
Director T. E. Gibbon (no stock in his name)		

Purely a real-estate corporation.

LOS ANGELES, February 5, 1896.

DEAR SIR: Answering your L 12 of January 29, with reference to the Terminal Road, I inclose herewith a sketch showing land owned by the Los Angeles Terminal Land Company in Wilmington school district, as shown by book No. 6 in the county assessor's office.

The only land shown on Rattlesnake Island, as owned by the Los Angeles Terminal Railway Company, is 42 acres at the point. This sketch is not drawn to scale, but will give you an idea of the situation. Two thousand one hundred and twenty-three acres are shown as belonging to the Los Angeles Terminal Land Company, which, from all I can learn, is a separate and independent corporation from the Los Angeles Terminal Railway Company. They have sold lots in their town site on Rattlesnake Island, but to what extent I can not learn. I am advised by Mr. S. P. Jewett that they paid \$300,000 for the land; that the road to Pasadena, Rattlesnake Island, and Glendale cost them \$750,000; and the Altadena Branch cost them \$100,000. I have always understood that the road stood them about \$1,600,000, but this is evidently a mistake, and must be the amount for which the road is bonded.

Yours, respectfully,

J. A. MUIR, *Superintendent.*

MR. H. E. HUNTINGTON,
*Assistant to President Southern Pacific Company,
23 Broad street, New York City.*

PORT LOS ANGELES, March 2, 1896—1 o'clock p. m.

SHIP DUNBOYNE.—REPORT OF DAMAGE TO SHIP AND WHARF IN STORM.

Sunday March 1: Strong southwest wind, with a heavy swell setting in from the southwest, the ship *Dunboyne* on the southeast side of the dock; toward midnight wind shifting to the northeast, with light rain; weather cold and raw, with no sign of southeast weather.

Monday March 2: Misty; wind northeast; barometer 30.20; fog and light rain. Held consultation with Captain O'Neil of ship *Dunboyne* regards the weather and towing ship away from the dock; came to understanding that if the weather did not clear up, would take the ship away before nightfall. Had a fireman on board of *Collis*, and to guard against accidents put two deck hands on board at 10.30 a. m. Toward noon wind hauling to the eastward and southeast. Captain O'Neil wanted to be towed away from the dock; got hawser on *Dunboyne*, when wind shifted suddenly, with a squall to the southward, and blew violently all afternoon, bringing a heavy southerly swell; with it immediately let the head and stern lines go from the ship, but held on to the buoy breast lines, going ahead with the *Collis*, with the intention of hauling the ship gradually away from the wharf; then would ship the buoy lines from the ship. Found that the *Collis*, although under full steam—115 pounds—was not able to work the ship broadside to wind, and sea, by reason of swell got so

S. Doc. 18—14

heavy it would throw the stern out of water and cause propeller to race, losing the little advantage that had been gained.

The *Corona* came along, and as the possibility of *Collis* getting *Dunboyne* away from wharf was very slight, signaled for *Corona* to assist. Much time was lost in *Corona* getting line to *Collis* by reason of heavy swell and *Collis* being inside of buoys.

After several attempts *Corona* got anchor off fore-castle deck and anchored to windward of buoys. Sent big wharf boat to *Corona*, who brought her 8-inch line to *Collis*. During all this time the sea increasing. About the time the *Corona* got ready to tow, the steel-wire hawser to the after buoy parted about 60 feet from the buoy, which released the strain and the vessel immediately forged ahead and was towed clear of the wharf.

Damage to wharf consists of 19 fender battens more or less broken; to the ship, starboard cathead torn out of the angle irons, with topgallant bulwarks strained for about 25 feet.

FERDINAND EMIL DORNFIELD,
Wharf Master and Master of *Collis*.
HENRY CROOK, Mate *Collis*.
WILLIAM HORNE, Engineer *Collis*.
FREDERIC GEORGE LUCAS, Foreman Wharf.

PARTICULARS OF DAMAGES TO SHIP DUNBOYNE.

Starboard topgallant bulwark bent inward for about 25 feet, which necessitates taking off the plate to the sheer strake and having plate rerolled. Lignum-vite main pin rail back of above-mentioned plate split so that it will have to be removed up to scarf. Starboard cathead torn out of angle irons holding it so that it had to be completely removed in order to replace.

Two deadlights, two half ports, main sheet bolt, and two gangway bolts on starboard side damaged so that they had to be renewed.

Port quarter pipe at break of poop cracked. Starboard bulwarks at break of poop slightly bent inward. Main brace, topsail runner, and main-brace pennant carried away. Two stanchions supporting main starboard bulwarks bent. Damage to bulwarks at break of poop but slight, and captain agreed to make no mention of it.

A. M. JAMISON, Agent.
FERDINAND EMIL DORNFIELD, Wharf Master.

[Telegram.]

LOS ANGELES, March 3—3 p. m.

J. A. F.:

Agent Port Los Angeles reports, from what he can now learn, that the damages to the *Dunboyne* will not exceed \$300. Only damage sustained was lifting of cathead and bending in of bulwarks from fore-castle head to forerigging, and at another point along about waist. No stanchions were broken.

J. A. M.

[Telegram.]

SAN FRANCISCO, March 3, 1896.

J. A. MUIR, Los Angeles:

How much steam did the *Collis* have when she took hold of the *Dunboyne*, and what is the reason she could not handle her? She has handled ships much larger than this one in a storm.

J. A. F.

[Telegram.]

LOS ANGELES, March 4—11.20 a. m.

J. A. F.:

Collis is allowed 120 pounds steam. When she took hold of *Dunboyne* she had 115, and was blowing off. When *Corona* took hold she had 95 pounds. In trying to haul *Dunboyne* out it was attempted to haul her ahead and by having off-shore breast made fast to buoys they would heave her out as she went ahead and keep her clear of dock and prevent damage. This the *Collis* was unable to do on account of sea

being so choppy that her propeller would fly out of water and lose any headway that had been gained. It was then *Corona* gave a line to *Collis* and both started ahead, but after breast line of *Dunboyne* gave away, which would allow quarter of ship to come in on dock, then *Collis* went ahead along edge of wharf and pulled ship out that way. Wind was from south and was blowing vessel on dock.

J. A. MUIR.

[Telegram.]

LOS ANGELES, March 12—12 m.

J. A. F.:

Referring to my telegram of yesterday. Propeller was evidently broken at the time *Collis* was getting *Dunboyne* away from the dock. This may explain the difficulty.

J. A. MUIR.

LETTERS FROM SHIP MASTERS ABOUT PORT LOS ANGELES.

PORT LOS ANGELES, CAL., August 23, 1895.

DEAR SIR: I can not leave Port Los Angeles without expressing to you and the company you represent my admiration at the prompt dispatch your men have shown in handling the cargo of my vessel, the *Lady Isabella*. It is the quickest dispatch that any cargo under my care has ever received.

I further desire to say that you are well fixed at the wharf for the handling of both ships and cargo in a prompt and efficient manner. I have been to many ports in my seafaring life, and I am willing to assert that Port Los Angeles gives as much satisfaction as any port I know of, both as a safe port and the expedition in unloading of freight and the handling of the ship, as well as for port charges and charges for services rendered.

I take great pleasure in recommending Port Los Angeles to owners and captains of vessels.

Yours, truly,

JNO. WYNNE JONES,
Master British Ship *Lady Isabella*.

MR. J. M. CRAWLEY,
Assistant General Freight and Passenger Agt.,
Southern Pacific Company, Los Angeles, Cal.

[Translation.]

THE EDITOR OF THE BORSENHALLE, Hamburg:

You would oblige me by publishing in your esteemed journal the following statement:

Port Los Angeles, on the Pacific Coast, is not universally known to the seafaring and commercial people, but offers so many opportunities to the maritime trade that it seems to me opportune to give here several interesting data anent the great facilities which this port offers to vessels for discharging and receiving freight. We arrived at Port Los Angeles on the 11th of August, and approaching the great wharf we met a great four-master with valuable freight, and one three-mast schooner near the coast. After the *Artemis* was cleared we began on the 15th with unloading our vessel, and at 5.45 o'clock in the evening we had transferred 2,370 barrels of cement directly into the railroad wagons. The next day was Sunday, but if a man likes to work he can do so. Monday, the 17th, we resumed our work at 7.30 o'clock in the morning, and at half past 4 in the afternoon the whole freight consigned to that port was discharged. Then we went back to the roadstead, where we cast anchor. Our vessel had a very imposing appearance while lying alongside of the big wharf. As much as I can judge, all ships can here discharge their freight in all seasons of the year. The breakwater is a very grand structure more than a mile long; the mooring buoys are fastened to 7½ ton anchors by 2-inch chains. A towboat lies near the shore ready for use, day and night. The costs of towing are trifling. Good, clear water can be had at cheap rates. The mooring ground is excellent. The place where the vessels discharge their freight on the wharf has 24 feet of water the whole year round.

The customs and port authorities treated us with great courtesy and gentlemanlike consideration.

R. MEHRING,
Master of the Hamburg Barque *Artemis*.

PORT LOS ANGELES, CAL., August 19, 1896.

PORT LOS ANGELES, CAL., *January 23, 1896.*

JOURNAL OF COMMERCE AND COMMERCIAL BULLETIN,

New York:

I have finished discharging a cargo of coal into the bunkers here and desire to express my admiration of the good work done in the handling of the same and the ease and safety with which a vessel lays at the wharf.

On my trip down to Port Los Angeles I encountered very heavy weather all along the coast, particularly off Point Concepcion. After rounding Point Dume, as I approached port, I was surprised to observe how the waves gradually moderated, and after arriving at the anchorage to find that the sea was comparatively smooth.

Since I have been laying at Port Los Angeles a heavy southeast gale has been prevailing all along the coast, the bar at San Francisco breaking, yet no bad effect has been felt here, either from the sea or the wind.

I can conscientiously say that with a breakwater Port Los Angeles would be as fine a harbor as could possibly be desired, and I must say that in my judgment it has the preference over any place in this locality for the construction of a deep-water harbor and a harbor of refuge.

I have been sailing on the Pacific Coast thirty-five years and am thoroughly acquainted with every port on it that does any shipping business.

Very respectfully,

C. H. ANDERSON,

Master American Steamer Progresso.

PORT LOS ANGELES, CAL., *May 7, 1896.*

EDITOR NEW YORK MARITIME REGISTER:

I have finished discharging a cargo of 2,800 long tons of general cargo, from New York, at Port Los Angeles and taken on board 550 tons of ballast, and can say that the work done here in discharging ships, both for speed and carefulness of handling, can not be surpassed anywhere.

The Southern Pacific Company does everything in their power to assist the shipping, and shipowners sending their vessels here will find their interests are looked out after.

I consider Port Los Angeles a safe port, and would be glad to accept another charter for there at any time.

Yours, respectfully,

R. L. LEONARD,

Master American ship Chas. E. Moody.

PORT LOS ANGELES, CAL., *January 15, 1896.*

NEW YORK MERCANTILE SHIPPING GAZETTE,

New York:

Referring to the question of selecting a suitable location for constructing a breakwater, with the view of obtaining a harbor of refuge for the southern coast of California, and also a harbor that will furnish room and facilities for handling to the best advantage the shipping business of southern California, for the present and for future years, I will state that of the two ports that offer any advantages in this direction, Port Los Angeles and San Pedro, Port Los Angeles appears to me by far the more desirable location.

Port Los Angeles is almost completely protected by the surrounding land from any gales that are liable to occur. The only point that is at all exposed is the southwest, and it is a well-known fact that in this locality the storms never blow for more than a few hours from this direction. If a breakwater were built, protecting the shipping from this point, a perfect harbor would be obtained. The cost of maintaining such a breakwater would be very little, as there would only be the natural settling of the rock for a few years to contend with.

The holding ground at Port Los Angeles can not be surpassed anywhere, there being no rocks or any formation that would foul an anchor.

The approach to the harbor is free from all obstructions and dangers, so that as a harbor of refuge it would be all that could be desired.

That part of San Pedro Bay in which it is proposed to construct a breakwater is not protected from the southeast, from which point the heaviest and most dreaded gales on this coast blow.

The anchorage is not good, as has been proven by the number of vessels that have lost or dragged their anchors, often with disastrous results.

The San Gabriel River empties into Wilmington Slough, which, at its estuary, has and is continually depositing large quantities of sand, and as time goes on the whole

harbor will either fill up or there will be the continual expense of dredging, in addition to the natural expense of maintaining the breakwater.

As for reefs and rocks, the *America* in 1887, after dragging her anchors, drifted on the then unknown rock on which the bell buoy is now placed and broke her back. The *Respigadera* in 1888 ran on the reef opposite Point Firmin while making port with a leading breeze and was a total loss.

As for the inner harbor proposition at San Pedro, there is not now sufficient water on the bar to float a large ship when loaded, so that in every case a ship drawing over 18 feet has to be lightened before being towed in and unloaded, and in loading outward has, after loading part of her cargo at the wharves, to tow out and have the balance of her cargo lightened out to her. As it is risky business taking large ships in and out over the bar through the channel on account of its crookedness and narrowness, it is seldom attempted, the last case being that of the ship *James Newmirth*, which stuck on the bar in towing out in 1883 and narrowly escaped serious damages.

As I have before stated, one important feature to be considered in making the proposed harbor is to have a harbor of refuge, and the most desirable quality of such a harbor is to have it easy of approach, with a clear entrance. This can not be obtained by dredging Wilmington Slough, as will be seen by referring to the chart, and a sailing vessel would stand a poor chance of sailing in through the narrow channel a mile in length and 400 feet in width into the large basin that is proposed, even if she could get over the bar. As the idea of the inside scheme is to keep the channel clear by the flow of water through it from the sea to the large basin and vice versa, there will always be a deposit at the estuary. This will always form a bar, and the bar will cause trouble. The result will be a bar-bound harbor.

During the past three years I have made 33 trips to Port Los Angeles, and at no time have I lost one moment's time in discharging my cargoes through bad weather or heavy sea. I consider Port Los Angeles a safe port, and, as far as safety and business facilities are concerned, would as soon discharge a cargo here as at San Francisco. I have been on this coast for ten years, and am thoroughly acquainted with all the ports from the Columbia River to San Diego.

Yours, respectfully,

THOMAS GUNDERSON,
Master Steamer *Alcazar*.

PORT LOS ANGELES, CAL., April 11, 1896.

LYOYD'S SHIPPING INDEX,
London, England:

I beg to have the following letter inserted in your widely circulated paper.

I arrived at Port Los Angeles March 28, and after arrangements had been made for discharge of cargo my ship was brought alongside of the wharf and cargo for here, consisting of 1,300 tons general merchandise, of which the bulk was window glass, was discharged in three and one-half days.

For quick work and good dispatch I have never seen the work done here surpassed in any part of the world.

Although while laying at the wharf I experienced a stiff southwest breeze, no inconvenience was suffered from it, and the discharging was carried on without any difficulty.

The mooring system in all its details is perfect, and can not be surpassed.

Since leaving the wharf, while laying at the anchorage, I experienced a moderate southwest gale, which, from the reading of the barometer (29.80), the general appearance of the weather, and the heavy sea rolling past Point Dume, must have been very severe offshore. During the blow my ship lay comfortably at single anchor, which proves conclusively that the holding ground is good and that the bay is well adapted for safe anchorage. Of course it is well understood that a lee shore is bad anchorage, but the contrary is accounted for by the fact that the mountains of the Coast Range prevent the winds from blowing home, and the gradually sloping sea bottom of the bay retards the swell so that it does not attain the size and force that it would under ordinary circumstances. These conditions can not be well understood by those who have not visited this harbor, even by shipping men. This was the case with myself, as I had experienced a similar gale in 1886 in the bark *Scottish Wizard* in San Pedro Bay. At that time some half dozen ships dragged their anchors, the ship *Ballumbie*, Captain Wood, among the number, dragged so much that she touched the bottom several times, and had it not been for the timely abatement of the storm would have added another disaster to the many that have occurred at that unfortunate anchorage, which is exposed to both the wind and the sea, and is noted for its foul sea bottom.

The great advantage of Port Los Angeles, as compared with neighboring ports, is the safety of the ships, the dispatch given, and the general policy of the Southern

Pacific Company of doing everything in their power for the interests of the ship-owners.

I should accept a charter for Port Los Angeles at any time.

Yours, faithfully,

GEORGE HANSELL,
Master British Bark Fernbank.

LOS ANGELES, August 10, 1895.

DEAR SIR: I take pleasure in writing to you, as I have stated to you that the cargo of the *Eclipse*, 2,153 tons, was handled at Port Los Angeles as quickly and as well as it could possibly be handled in San Francisco, and if you keep up the good service at Port Los Angeles which was given to my ship and cargo I have no hesitation in saying for myself that I would sooner be chartered for Port Los Angeles than for San Francisco, and I am sure that if other vessels and cargoes receive the same prompt dispatch and quick handling the masters thereof will entertain the same opinion as I do regarding Port Los Angeles.

Yours, truly,

JOHN H. PETERSON,
Master Ship *Eclipse*, of San Francisco.

Mr. J. M. CRAWLEY,
Assistant General Freight and Passenger Agent, Los Angeles.

[Translation of letter.]

PORT LOS ANGELES, March 16, 1896.

HAMBURGER BORSENHALLE, *Hamburg*,
WESER ZEITUNG, *Bremen*:

On March 3 I arrived here with my ship *Philadelphia* of Geestermunde from Hamburg with a cargo of cement and mineral water, total about 2,720 (2,240) tons. A gale from southwest was raging but the sea did not prevent our anchoring, and it follows that this harbor offers the necessary depth for safe anchorage. On March 9 we hauled into the pier and the next morning commenced to discharge. We got out that day 1,400 tons cement, and had we not been compelled to wait for ballast that comes from Los Angeles the *Philadelphia* would have been ready as early as Friday (13th). To discharge 2,720 tons and take in 800 tons ballast in three to four days is in my opinion very quick dispatch. Vessels here receive in every way good treatment. All expenses are comparatively low. Saturday evening, 14th, we again hauled from the pier, and I can only wish soon again to be chartered for this port.

JOHN WACHTER,
Captain of *Philadelphia*.

PORT LOS ANGELES, CAL., January 14, 1896.

JOURNAL OF COMMERCE AND COMMERCIAL BULLETIN,
New York:

As the question of a suitable site for the proposed breakwater is being considerably agitated on this southern coast at present, I beg to state that I have made six voyages to Port Los Angeles during the past twelve months, and have laid at the wharf during every season of the year. At no time since I have been running here have I ever been delayed in discharging through stress of weather or heavy sea.

The holding ground here is good. There are no reefs or rocks that offer any dangers to ships in approaching the port, and the protection to the shipping from storms, common to this latitude, is perfect from the southwest. However, it is very rarely that storms come from that direction; when they do, lasting for only an hour or two, as they are then in transit from the southeast to the northwest and north-northwest. I consider Port Los Angeles a safe port as it is now, without any improvements, and if the breakwater is constructed, as proposed, it will be made into a first-class harbor with every facility that can be desired by the shipping business.

Yours, very respectfully,

H. M. HANSEN,
Master Norwegian Steamer *Peter Jepsen*.

LOS ANGELES, *September 20, 1893.*

DEAR SIR: As requested, I proceeded to Port Santa Monica, and after a careful survey find good anchorage and good holding ground; also buoys, properly placed, for moorings for ships to load or discharge cargoes, with all the appliances requisite to facilitate dispatch; and I consider it a safe port and hereby respectfully indorse the reports of Capts. J. F. Chapman, Watson, and others.

Yours, very truly,

BENJ. B. JACKSON,

Master of the American Ship James Nesmith.

SUPERINTENDENT SOUTHERN PACIFIC RAILROAD,
Los Angeles, Cal.

PORT LOS ANGELES, CAL., *August 10, 1896.*

DEAR SIR: I beg to submit the following report of my experience while at Port Los Angeles: The facilities for discharging are excellent, the port charges are very reasonable, and every attention is paid to the ships and their moorings while laying at the wharf by the Southern Pacific Company.

It is my opinion that in the summer season ships could depend upon working every day.

There are no hidden dangers in the vicinity of the wharf, and the holding ground is good.

If a breakwater were built it would make as good a port as there is anywhere.

Yours, respectfully,

A. MCKINNON,

Master British Ship Gulf Stream.

EDITOR LLOYD'S WEEKLY SHIPPING INDEX,
London, England.

PORT LOS ANGELES, *August 18, 1896.*

MR. EDITOR: I arrived here from London, England, August 4. Another vessel, the *Gulf Stream*, being in the berth I was to occupy I did not dock till the 7th. In six and one-half days, Sunday intervening, we discharged 2,080 tons cargo, over 200 tons of this being coke, which is difficult to handle. This I consider excellent work.

We were favored with very fine weather, and not a hitch arose as far as our moorings were concerned. The Southern Pacific Company supplies all moorings, and my ship lay as comfortably as in a London dock during my stay at this place.

I consider that Port Los Angeles affords even better facilities than San Francisco for rapid discharge of cargo, and trust that through the medium of your paper this letter may draw the attention of shipowners.

The holding ground is excellent and the anchorage is free from any danger. I anchored in 7 fathoms of water within half a mile of the great wharf.

I consider Port Los Angeles a safe port for a vessel of any draft.

Yours, respectfully,

HENRY DAVIES,

Master British Ship Drumcliff.

LLOYD'S INDEX, *London, England.*

LOS ANGELES, CAL., *August 18, 1896.*

DEAR SIR: I desire to send you the following communication regarding Port Los Angeles, Cal., as this is my first voyage here, and I found before leaving London that I could get very little information about the place:

I loaded at Newcastle-on-Tyne and London with about 2,100 tons of general cargo for Port Los Angeles, and after a voyage of one hundred and thirty-eight days was picked up by the tug *Collis* (which is always in attendance at the port) outside of Santa Monica Bay.

The Port Los Angeles Wharf runs out into this bay about a mile, and it is one of the best and most massive structures of its kind I have ever seen.

The Southern Pacific Railway Company, who operate the wharf, extend every facility to vessels discharging, and notwithstanding that my cargo was pretty well mixed and only two hatches working, I was at the dock only six and one-half days, including Sunday.

Towage is exceedingly moderate; my total expenses under this head being only \$50 in and out.

The anchorage is all that can be desired, and while, of course, I saw no rough weather while there, I am pretty well satisfied that a vessel as large as the *Drumcliff* could find secure holding ground even under the most unfavorable circumstances.

While the wharf seems to me to be somewhat exposed to southeast gales, I am informed that these occur very infrequently, and as far as my experience goes I must admit that the *Drumcliff* (which is the largest ship that has yet been at the wharf) lay alongside for six and one-half days without a bit of chafing or the parting of a single line.

The officials on the dock are most accommodating; and I can confidently recommend that port to shipowners and masters of vessels as a good place under most circumstances, and in regard to dispatch, superior to almost any port that I have been in.

The city of Los Angeles is distant inland about 14 miles. It is a growing city of about 100,000 inhabitants, and there is every indication that it will have a steady growth, which, of course, will reflect on the port, and an increasing amount of shipping may be looked for year by year.

I am, yours, very truly,

HENRY DAVIES,
Master British Ship *Drumcliff*.

EDITOR OF FAIR PLAY,
London, England.

PORT LOS ANGELES, December 28, 1895.

THE NEW YORK JOURNAL OF COMMERCE, New York:

I have been asked to express my opinion as to which place, Port Los Angeles or San Pedro, would be the best location for the deep-sea harbor, and I beg leave to answer the question through the columns of your valuable paper.

In order to introduce myself I will say that I came to the Pacific Coast in 1873, and have been engaged here ever since in the seafaring business, having had charge of sailing vessels and steamers since 1880. I am thoroughly acquainted with all and every port on this coast from Puget Sound to Lower California.

From reasons given below, I believe that Port Los Angeles is the better place for the breakwater. At one time I was in favor of San Pedro, and even signed a petition in favor of that port, but this was before I had been at Port Los Angeles, and I was not aware of the possibilities that it possessed. At the present time, after having made some 28 trips here, my opinions have become entirely changed as to the merits of the two places.

The first reason that I give in favor of Port Los Angeles is that it already has deep water where the harbor is to be built, which San Pedro has not.

Second. It is protected from southeast gales, which San Pedro is not.

Third. Every vessel can get inside and out again without the assistance of a tug, which can not be done at San Pedro.

Fourth. It is easy of approach and has no outlying reefs or rocks, thus giving a clear anchorage, a feature so much appreciated by shipmasters.

Fifth. As Port Los Angeles now is, it is perfectly safe for the largest ship afloat to lay alongside the wharf, where she can discharge with safety into cars, while at San Pedro ships have to be lightered a great distance out at sea, which is expensive and dangerous, particularly in the winter season, on account of its exposed condition.

Sixth. With the breakwater once built at Port Los Angeles, the expense of maintaining the same would be very small, while at San Pedro the continual cost of maintaining a sufficient depth of water, owing to the debris deposited by the San Gabriel River and Wilmington Slough, would be enormous.

In conclusion, I would say that during the many voyages I have made to this port, although experiencing some very heavy weather and seas out in Santa Barbara Channel, on approaching Port Los Angeles I have found the swells diminish and cease altogether when getting within a couple of miles of the harbor. I have laid alongside the wharf during all kinds of weather, and have not seen the time when I could not load or discharge my cargo with safety and dispatch. As I am writing this, having about finished discharging a cargo of lumber here, it is blowing a perfect gale from the northwest. At the same time there is a large foreign steamer discharging a 4,500-ton cargo of coal into the bunkers on the north side of the wharf, while my steamer lays on the south side, without suffering any inconvenience from the sea or weather and doing business with dispatch equal to any that could be given in the most perfect landlocked harbor.

Yours, respectfully,

GEORGE DETTMERS,
Master Steamer *Alcatraz*.

THE FAIRPLAY,
January 3, 1896.

The following copy of letter has been sent me:

SHIP EATON HALL,
Port Los Angeles, November 14, 1895.

DEAR SIR: Before we leave this port I wish to express to you my satisfaction with the way cargo is handled and the facilities you have at this mole for the quick working and dispatch of ships. The *Eaton Hall* arrived in the bay Saturday, 9th instant, and we docked Monday, the 11th, and began to work at 3 p. m. that day. In twenty-seven working hours we have discharged say 1,700 long tons, or an average of 63 tons per hour, of rough general cargo. I have come to the Pacific Coast now for the past seventeen years as a shipmaster, and I have never seen that equaled yet in San Francisco or Portland. Your facilities for mooring the vessel and securing her at the wharf beat any dock in San Francisco, and the courtesy and attention of your staff at the mole is not to be surpassed. From my experience of the Pacific Coast, I am certain that you will not have fourteen days in a year that a ship could not lie at all times in perfect safety and work at this wharf. In the near future I hope you will soon begin to export, and then you may expect to see a goodly fleet of merchant ships anchored in your bay. I shall never hesitate to recommend this port as a port where a ship can at all times lie in perfect safety and be sure of very favorable dispatch.

I remain, yours, very truly,

GEO. M. LAURISTON,
Master Ship *Eaton Hall*, of Liverpool.

Mr. J. M. CRAWLEY,
General Freight and Passenger Agent
Southern Pacific Company, Los Angeles, Cal.

In his annual report for 1895 the British consul at San Francisco devotes some space to Los Angeles. In referring to Port Los Angeles, which is 18 miles west of the city, he states that the Southern Pacific Company's wharf, which is nearly a mile long, is safe for the largest vessels, except for a few days in the year, and that the expense of discharging and receiving cargo is so much less than at San Pedro that the foreign-going vessels have abandoned the latter port. At Port Los Angeles they charge 2s. 6d. per ton for ballast delivered on board and 2s. per 1,000 gallons for water, against 7s. and 4s., respectively, at San Pedro. This difference is due to the fact that at San Pedro cargo is received and discharged into lighters, as foreign-going vessels can not get to the wharves in the inner harbor. The rates for dockage at Port Los Angeles, for all vessels over 200 tons, are 16s. a day for the first 200 tons and three-quarters of a halfpenny for every additional ton. With reference to discharging at Port Los Angeles, a letter has come to hand from Capt. Henry Davies, master of the British ship *Drumcliff*, dated Port Los Angeles, August 18. This vessel left Newcastle-on-Tyne and London with about 2,100 tons of general cargo for that port, and after a voyage of 138 days was picked up by the tug *Collis*, outside of Santa Monica Bay. The Southern Pacific Railway Company, he says, extend every facility to vessels discharging, and, notwithstanding that his cargo was pretty well mixed and only two hatches working, he was at the dock only six and a half days, including Sunday. The cost of towage was, he states, exceedingly moderate, his total expense under this head being only \$50 in and out. The anchorage was all that could be desired, and he was well satisfied that a vessel as large as the *Drumcliff*, which is the largest ship that has yet been to the wharf, could find secure holding ground, even under the most unfavorable circumstances. The depth of water alongside the wharf for 1,000 feet from the end shoreward ranges from 35 to 32 feet at mean low water, with a rise and fall of the tides of from 5 to 8 feet.

THE PORT OF LOS ANGELES—ANOTHER TRIBUTE.

The Southern Pacific Railroad Company at Los Angeles has received the following letter from the master of the ship *Port Elgin*, which will be of interest to shipowners. The letter was forwarded us by Mr. Rud. Falck, of Liverpool, who is the general European agent of the company. It is dated Los Angeles, Cal., December 20, and is couched in the following terms: "I have much pleasure in expressing to you my entire satisfaction with, and admiration at, the dispatch above vessel has had at Port Los Angeles. I never was anywhere before where cargo could be so quickly handled. In 50 hours 2,720 tons coal was discharged and 900 tons ballast loaded—work which would be hard to beat. I consider this a perfectly safe port. The holding ground is good, the wharf one of the finest I have seen, and the moorings, buoys, etc., all that could be desired. I would come to this port at any time in preference to any I have been to, and would be glad to get chartered back here soon."

A letter appeared in the last issue from the captain of the *Eaton Hall* in regard to Port Los Angeles, Cal. The following letter from the captain of the *Edinburghshire* respecting the same port has since come to hand:

PORT LOS ANGELES, CAL., November 27, 1895.

DEAR SIR: I have finished discharging a cargo of 1,400 tons of cement and general freight at Port Los Angeles, and am now ready to sail for Tacoma with the balance of my cargo. Previous to my arrival here I had been led to believe that this was a very dangerous port and altogether unfit for a vessel to call at, which statement I now know to be absolutely untrue. At 8 p. m. on 21st November, while my ship was lying at the wharf, the barometer being very low and the sky threatening, giving every indication of dirty weather, the wind set in from the southwest and increased to a moderate gale at 9.30 p. m., blowing fresh until 3 a. m., when it veered around to the northeast. The southwest gales are the only ones which affect the shipping at Port Los Angeles. During this blow, although there was a slight swell heaving in, my ship lay comfortably and easily on her lines, and could have discharged her cargo without any difficulty whatever. After this incident I consider Port Los Angeles a safe port, and I am only sorry that I could not discharge the balance of my cargo here and have the privilege of loading for a home port. The dispatch given here can not be surpassed anywhere, and, considering everything, Port Los Angeles compares favorably with any port on the Pacific Coast.

Yours, respectfully,

JAS. GUTHRIE,
Master British Bark *Edinburghshire*.

The EDITOR OF FAIRPLAY.

RAPID DISCHARGE AT PORT LOS ANGELES.

Ship owners and shippers will be glad to read the following testimonial on the subject of discharge at Port Los Angeles:

BRITISH BARK FORFARSHIRE,
Port Los Angeles, Cal., November 28, 1895.

SIR: I beg to call your attention to the convenience of this port and the facilities for handling cargo. There is an impression among many British shipmasters (in which I was included before by arrival here) that this is a bad shop, but I can assure you it is quite the reverse. A ship lays alongside the wharf and is provided with ropes for mooring by the Southern Pacific Railroad Company gratis, and 700 tons of merchandise is removed in eight hours and landed on the cars for transportation inland. The directions for this bay state that a ship has to slip and go to sea when a gale comes on. When making for this port I was overtaken by night, a low barometer (29.50), and a fresh gale from west-southwest to southwest. I hove to the wind until daylight, and kept away, to have a look at the place and work the ship out again. After passing Point Dume the wind fell to a moderate breeze and a towboat hove in sight, and I had a pleasant surprise by being assured, which was afterwards found to be true, that there was no danger for a ship to ride out a gale here, as the holding ground was good and sheltered from all winds but between south-southwest and west-southwest points, and these points are somewhat sheltered by the islands in that direction. I would have sailed out of this port, after unloading about 1,000 tons of cargo, in less than thirty-six hours, but the consignees wanted to send some cargo consigned to this port on to Oregon, and I have been detained three days for permission from the United States Government to carry it on. I beg you to insert this letter in your paper for the good of the shipping fraternity in general.

Yours, truly,

CODDEN EVANS,
Master of the Bark *Forfarshire*, of Glasgow.

The EDITOR OF THE JOURNAL OF COMMERCE.

SHIP DUNBOYNE, April 2, 1896.

SIR: I beg to submit the following report of my experience at Port Los Angeles to the readers of your widely circulated journal: I arrived here 16th February, with a full cargo of cement and merchandise from London, all consigned to this port, and sailed right in, anchoring at 10 p. m. about 2 miles west of the wharf. On landing next morning I was very agreeably surprised to find a magnificently constructed and equipped wharf or jetty projecting nearly a mile from the beach, with a perfect and secure mooring system sufficient to accommodate several vessels of any size at the

same time. The mooring ropes (12 inches to 16 inches manila hawsers) are lent to ships free of charge. The Southern Pacific Railroad Company, who own and operate the wharf, offered to discharge and ballast my vessel within the week, and have since, under my own observation, amply demonstrated their ability to do even better work, the ship *St. John*, from New York, having discharged a general cargo, 2,600 tons, and ballasted in eight days, and the German ship *Philadelphia*, from Hamburg, with a full cargo of cement, 2,750 tons, had the same work done in five days, the latter vessel in one day discharging no less than 1,400 tons. In my own case there was no necessity for this rapid dispatch, as I was negotiating for an outward cargo. Nevertheless, 1,700 tons were discharged in two days. All cargo, except coal, is discharged directly into the railroad company's cars. The only winds that affect vessels are the winter southeast and southerly gales. They very seldom blow home with any force, but as the wharf is exposed to this quarter it is very necessary to haul off and anchor until the weather clears. The company's powerful steam tug is always at hand, under steam, and performs the service free of charge. On 2d March, while my vessel was at the wharf, we had a typical southeast gale, currently reported to be the severest experienced in this section for many years. We unfortunately were moored to the exposed side, and, while being towed clear, damaged our starboard bulwarks slightly. I have just completed loading a full cargo of barley for U. K. at the wharf, with as much ease and facility as could be afforded by any port on the coast. In addition to the present jetty, which is probably the best of its kind in the world, it would be necessary, in order to obtain an absolutely smooth harbor, to construct a breakwater of some sort. This, in such a tranquil climate, would hardly require to be a very massive or costly work. Good water is laid on the wharf and given to ships at a merely nominal charge, and supplies of all kinds are comparatively cheap and readily obtained at Santa Monica or Los Angeles. Owners and masters using this port can rely on their vessels receiving from the Southern Pacific Company exceptionally good treatment, and the courtesy and consideration of the company's officials, both at the port and in Los Angeles, leaves nothing to be desired.

Yours, faithfully,

JOHN O'NEIL,

Master of British Ship Dunboyne.

THE EDITOR OF FAIRPLAY.

PORT LOS ANGELES, CAL., July 4, 1896.

DEAR SIR: Kindly insert the following in your valuable paper:

I have now been at Port Los Angeles for three weeks, having discharged 3,400 tons of coal and taken on board 1,100 tons ballast. Part of this time I lay at anchor in the stream without a pound of ballast in my ship. The anchorage is first-class, and free from any dangers. I consider Port Los Angeles in every respect a safe and good port. One point to which I desire to draw attention is that as there is no waste in discharging coal, it being dumped directly into bunkers on the wharf, if the coal is in the ship she will surely turn it out. Shipowners and shipmasters will find that their ships receive prompt despatch here, and that everything possible is done by the Southern Pacific Company to forward their best interests.

Yours, respectfully,

J. GUNSON,

Master British Ship Dunsyre.

THE EDITOR OF FAIRPLAY.

THE PORT OF LOS ANGELES.

SHIP PORT ELGIN,

Port Los Angeles, Cal., December 20, 1895.

DEAR SIR: I have much pleasure in expressing to you my entire satisfaction with, and admiration at, the dispatch the above vessel has had at Port Los Angeles. I never was anywhere before where cargo could be so quickly handled. In fifty hours 2,720 tons coal was discharged and 900 tons ballast loaded—work which it would be hard to beat.

I consider this a perfectly safe port. The holding ground is good, the wharf one of the finest I have seen, and the moorings, buoys, etc., all that could be desired. I would come to this port at any time in preference to many I have been to, and would be glad to get chartered back here soon.

Yours, faithfully,

W. C. W. RENNY.

THE HARBOR AT LOS ANGELES.

EDITOR MARINE JOURNAL: There have been so many misstatements current lately in regard to the Port Los Angeles Wharf being an unsafe harbor for ocean vessels that I feel it incumbent upon me as a master mariner to give shipowners and charterers abroad the benefit of my actual experience at that port, and now beg to do so through the medium of your widely circulated journal. Anyone who is familiar with the subject, and who is willing to give an honest opinion thereon, must confirm me in the statement that that place affords at all times a perfectly safe landing for steamers, sailing ships, or craft of any kind, and it can easily be made one of the finest harbors in the world by the erection of a breakwater. As everyone knows, the ports on the Pacific Coast are not any too plentiful, and it therefore especially behooves us to give our earnest and hearty support to every effort that is made to create a harbor which will be highly advantageous not only to the shipping of this coast but to the world's commerce. We should have only a feeling of gratitude toward those who are endeavoring to benefit us by making another good harbor, and their efforts should not be frustrated by misrepresentation as to the feasibility of their plans. I can fearlessly testify that in strength and design the Port Los Angeles Wharf has no superior anywhere, and the site chosen is decidedly the best, from all points of view, that could have been selected on that coast line.

During my visit to Port Los Angeles in April, 1894, while in command of the steamer *Wellington*, I experienced what was pronounced by residents to be the worst weather in that vicinity since the completion of the wharf; and yet I had no difficulty in laying alongside the wharf, and although there was a gale of wind blowing and a little swell, I discharged 900 tons of coal a day. During the gale I found that from a couple of miles to the southward of the wharf and along the coast toward San Pedro, the sea and swell increased until it ran very high, so much so that at Redondo the steamer *Santa Rosa* could not make a landing. She came on to Port Los Angeles Wharf and made fast with no trouble whatever.

Again, during January, 1895, I experienced a practical test of what is to be expected alongside the wharf during a hard winter's gale, having laid there through a storm of two day's duration and of unusual violence, with over 2,000 tons of coal on board, in perfect safety. Opportunities such as these seldom occur for determining whether the site of the wharf is suitable for constructing a safe and commodious harbor, as the weather throughout the year is usually very fine; therefore it is a pity that my experience should be lost sight of when the subject is under consideration. I have always looked upon the wharf at Port Los Angeles as a preparatory step to the establishment of an ocean roadstead, situated, as it is, but a few miles from the speed track in Santa Barbara Channel, chosen by the Federal officers to test the speed of our war vessels. A finer rendezvous for the Navy could not be obtained anywhere on the coast, and with the addition of a breakwater it would be a safe and easy harbor of access.

Since the opening of the wharf for business in May, 1893, up to January, 1896, 858 vessels have landed cargo there, and a glance at the statistics of the custom-house must convince the most skeptical that Port Los Angeles Wharf is an assured success and a safe place for shipping. These were the imports: Coal, 279,833 tons; merchandise, 47,828 tons; cement, 9,185 tons; lumber, 9,363,149 feet; ties, 1,476,831. Exports: Merchandise, 17,435 tons.

In conclusion, the above account is based upon a careful study of the locality and a knowledge gained by practical experience; and I trust that should the Government grant an appropriation to make a harbor in that neighborhood no grave error will be made by selecting any other site than that of the wharf in Santa Monica Bay, which has, to begin with, every natural advantage.

COLIN S. ALMOND,
Master Steamer *Wellington*.

SAN FRANCISCO, February 17.

[Telegram from Senator White.]

WASHINGTON, D. C., December 21, 1896.

JOHN F. FRANCIS,
President Free-Harbor League, Los Angeles, Cal.:

Have been informed that Mr. Corthell, the railroad engineer, claims that he is in possession of a statement from a member of the Commerce Committee to the effect that the Board now in session in Los Angeles was so appointed as to require absolute exclusion of all consideration of inner harbor at San Pedro. Such an assumption is unwarranted, and is in harmony with the arrogant impudence which has throughout characterized that side of the controversy. The statute will govern the Commission,

and the gentlemen composing it will undoubtedly follow the obvious requirements of the river and harbor bill, which demand a location of the harbor at the most desirable point. If the inner harbor constitutes a determinative element in solving the matter of eligibility, there is no law requiring the Board to exclude this important factor. The requirements of the situation imperatively necessitate the most beneficial location, and this involves the consideration of all circumstances, be they great or small. No letter from any Senator or Congressman can define or limit the duty of the Board. No dictation from any source, near or remote, can legitimately prevent the fixing of the improvement at the most suitable place. The act of Congress does not demand or permit the exclusion of those advantages which the Almighty has accorded without consultation with the Southern Pacific.

Please send me copy of Mr. Frye's letter.

STEPHEN M. WHITE.

[Extract from letter of February 28, 1896, to Senator White. Subject, San Gabriel River.]

The river and harbor act of 1892 especially charged the then Secretary of War to appoint a Board of five engineers, officers of the United States Army, whose duty it should be to make careful and critical examinations of the harbor sites of this locality and report thereon. On page 9 of their report (Ex. Doc. 41, Fifty-second Congress, second session) can be found, by anyone desirous of the truth, the following statement regarding San Pedro:

"No important streams discharge into this estuary. The San Gabriel River, which in former times occasionally emptied the waters of its higher floods into the inlet, now reaches the ocean through a new channel 10 miles to the southward."

The "Downey" sheet of the United States Geological Survey shows the situation very clearly.

The best site for a deep-water harbor is that which best combines the essentials of a harbor of commerce and a harbor of refuge. We believe that San Pedro is superior in all these respects to Santa Monica.

While it is not within my province as a civil engineer to discuss the military phase, still it is a condition that is inseparable from commerce, and I may be allowed to draw attention to the report of the Board of 1892, and to the statement of General Craighill before the Senate Committee on Commerce, in April of the current year—"That the Board was unanimous in the view that San Pedro and its inner harbor is a more worthy object of defense and is more easily defended than any harbor of refuge that could be created at Santa Monica." This statement of General Craighill serves to bring out the point that a true harbor of refuge must be a refuge from stress of war as well as stress of weather. The opinion of the 1892 Board on this subject is to be found on page 16 of Ex. Doc. No. 41, Fifty-second Congress, second session, and reads as follows:

"From a national point of view the capacity of the harbor for defense is a matter of the highest moment, since an indefensible commercial port is simply an invitation to attack in time of war. We have now too many such ports, and it is not desirable to increase the number."

In approaching the subject of the commercial harbor, I first take the standpoint of the business men and the structures they need.

The railroads I regard not as prime factors, but in their proper and useful sphere as accessories and conveniences of trade.

The business men need a location where they can build at moderate expense and individually own sheds, warehouses, elevators, etc., immediately alongside the ships' berthings. They need a location where drays and other vehicles drawn by horses can reach their warehouses and the ships' sides.

It would be a serious obstruction to trade to be compelled to use a railroad for every movement to and from a vessel. Suppose, for instance, a master needed some ship chandlery, a coil of rope, or stores of any kind. In a good commercial harbor he would send such supplies to his ship by wagon, and not be compelled to use a railroad. As exemplified by the long wharf, they can not find such a location at Santa Monica. This wharf and its approaches cost, according to Mr. Huntington's statement before the Senate committee, about \$1,000,000. The approaches, at his valuation, cost \$10,000 per mile of single track, which places the cost of the wharf itself at about \$950,000. The length of the wharf in 25 feet or more of water is 2,400 feet. Taking both sides of the wharf, there is available 4,800 feet of deep-water berthing, which has been obtained at a cost of \$198 per linear foot, and it is merely a place where ships and railroad cars can be brought side by side without the requisite commercial facilities for handling, storing, and distributing freight.

To provide these common business necessities before enumerated, and which exist in every commercial harbor of even the smallest pretensions, the wharf would need be doubled in width, at least, with consequent doubling of cost, raising the price to \$396 per linear foot of working space.

The structure is of perishable material, subject to ordinary decay and to the attacks of limnoria and teredo. It is of inflammable material and subject to risks of fire. It is presumable that the wharf is a good exponent of the best that can be done for the money in that situation.

All these points are of vital concern to commerce, as the traffic must pay rates that will furnish the interest on cost of construction and the expenses of maintenance and renewals.

There are recent decisions of court to this effect.

In comparison with the cost of this wharf I will submit to you the cost of a basin excavated from a tide flat and inclosed with masonry walls—permanent structures subject neither to decay nor to destruction by insects or fire.

The Barry docks, near Cardiff, constructed in this manner and having a depth of water of 39.7 feet at spring tides, cost about \$227 per linear foot of quayside. I refer you to volume 101 of the Minutes of Proceedings of the Institute of Civil Engineers. In proof that this cost was not unusually low I will cite the Alexandra docks at Hull, which cost about \$140 per linear foot of quayside, and where the walls were sometimes 62 feet high.

At the Portsmouth dockyard extension, Government work of a very substantial character, the basins, carrying a depth of 40 feet of water, cost from \$150 to \$185 per linear foot.

Some allowance must be made for the relative cost of work at the different sites, but after all reasonable allowance on this score has been made there will still remain the showing that deep-water docks with permanent masonry walls can be made on the San Pedro tide flats at no greater and probably less outlay for construction and much less for maintenance than structures of equal working capacity of perishable material built out to deep water in Santa Monica Bay. Furthermore, it is in accord with usual commercial harbor construction to bring the deep water in to the traffic rather than to carry the traffic out to deep water, the water being the most mobile. This method imposes no difficulties on vessels, while it greatly facilitates the successful solution of the multifarious questions connected with the land service.

There are 1,200 acres of tide flats at San Pedro available for the purpose. As a suggestive comparison, it may be stated that the entire water area in the docks of Liverpool and Birkenhead is about the one-half of this, viz, 545 acres.

The next point of commercial superiority of San Pedro is the low railroad grades between that point and Los Angeles. Comparing the Southern Pacific lines from San Pedro and Santa Monica, from San Pedro to Los Angeles the heaviest grade is on Alameda street, within the city limits. For 400 feet it is about 34 feet per mile. This distance is too short to constitute the ruling grade, which is about 30 feet per mile. In climbing off the beach at Santa Monica the maximum grade from the north portal of the tunnel to the top of the hill near the water tank, a distance of about 1 mile, is 158 feet per mile, but this also is for a short distance, the ruling grade being about 100 feet to the mile. From the top of the hill to Los Angeles the ruling grade is 53 feet to the mile. In evidence of these facts I file with you a profile from surveys made on the 17th instant, marked Free Harbor League Exhibit No. 1.

The effect of these heavy grades on the Santa Monica line is to more than annihilate the advantage which appears to attach to that place in point of distance, leaving the balance in favor of San Pedro. The same weight of engines can move more freight from San Pedro than from Santa Monica, and that is the point which concerns commerce, not the mere measured distances, upon which stress has been laid.

If the deep-water commercial harbor be made in the San Pedro flats its accessibility to railroads is too obvious to need comment. If, on the other hand, it should be decided to carry the traffic out to deep water in an outer harbor at San Pedro the accessibility to roads, although materially decreased, would still be less restricted than at Santa Monica. Should the plan for an outer harbor necessitate east-side roads passing to the west side they can readily do so by turning the head of the lagoon at Wilmington and avoid bridging. With reference to Santa Monica, I file with you a map and accompanying photographs, marked Exhibit No. 2, giving the line of high water taken by photographic survey of the morning tide of October 8 last. The map also gives other information on the subject of room for railroads, showing that little exists above high-water line outside the Southern Pacific right of way.

Coming to the marine side of a good commercial harbor, one of the first needs is facility for the installation of establishments to conduct rapidly and efficiently the repairs so constantly needed by shipping.

The San Pedro flats afford every facility for these purposes. At Santa Monica no such facilities exist, nor can they be created with any practicable outlay. Dredged channels to docks would fill by littoral current.

This point alone places Santa Monica in an inferior position. It would rank as a port of call and could not be considered a harbor in its fullest sense or a suitable terminal point for oceanic lines.

To the mail steamers rapid and efficient repairs are of the greatest importance. Repairs are chiefly connected with painting, damage to rudder, rudder post, propeller, or stem, all necessitating dry docking, for which Santa Monica presents no facilities whatever.

In connection with the possibilities of San Pedro as affected by draft of vessels plying to the Pacific Coast, I submit the following extract from a publication by the commission of the port of Portland (Oregon) regarding the deep-draft vessels laden with flour and grain cleared from that port for points beyond Cape Horn from September 1, 1894, to September 1, 1895:

Total number of full-rigged ships and barks, 105; total registered tonnage, 32,878 tons; maximum register of any one vessel, 2,570 tons; minimum, 707 tons; mean register of all vessels, 1,733 tons; maximum draft, 23 feet 5 inches; mean, 21 feet 3 inches; minimum, 17 feet.

Vessels—	No.	Percent.
23 to 23 feet 5 inches draft		
22 to 23 feet	3	2.8
21 to 22 feet	18	17.1
20 to 21 feet	57	54.3
Under 20 feet	22	21
	5	4.8
Total	105	100

Twenty-five feet at low water is the ultimate depth of channel contemplated by the port of Portland. No port with that depth need lack for vessels to carry cargoes in or out.

Observations of the wind have been kept at the custom-house at San Pedro and Santa Monica for the past six months. The original records I will file with you. In brief, these records show 91 per cent of the winds at Santa Monica to be within the semicircle from east to west, the prevalent wind being southwest. The site proposed for a breakwater at Santa Monica is open to all the winds that blow from the west end of the Ballona flats around to the highland back from Point Dume—an arc which extends from east-southeast around to west. The land between Ballona and Redondo is too low to be of any material shelter to the proposed breakwater site, and San Pedro Hill is too far off—18 miles—and lies too nearly end-on to be an effective wind-break.

The San Pedro records show 98 per cent of the winds to be in the semicircle from east to west, with the prevalent wind southwest. Both at Santa Monica and San Pedro there are generally light easterly airs in the morning, which toward noon change to moderate westerly breezes.

San Pedro is sheltered by high land on the west from north around to south and is thus fully protected from the prevailing winds. It is open to the southeasterly storms, which are of rare occurrence. These storms, while strong in comparison with the usual winds of this locality, would be considered small affairs on the Atlantic Coast. The evidence of the light-house keeper at Point Firmin as to the rarity and strength of the southeasterly storms would be particularly pertinent. As bearing on this point, I have examined the files for the past thirteen months of the Pilot Charts for the North Pacific Ocean, published by the Bureau of Navigation of the Navy. The chart for December, 1895, gives a probability of southeasterly winds for six days in the month with a force of 5. This was for longitude 122° 30', about 240 miles west of the coast. The chart for November, 1896, gives a probability of southeasterly winds close inshore for three days in the month with a force of 2. None of the other charts give any southeasterly winds. As the information of the Navigation Bureau is collected with infinite pains and published for the especial purpose of guiding and warning mariners, its bearing upon this point is of particular weight and importance.

To man's evidence I will add the silent testimony of the trees that grow on the coast. They have no bias save all their lives to turn from the wind that does the most fiercely assail.

Sailing vessels from foreign ports arrive between the islands of Santa Rosa and San Nicholas. From there Santa Monica has an advantage in point of distance of 5 or 6 miles, which is a matter of little moment in a long voyage.

With outbound vessels San Pedro has the weather gauge of Santa Monica. Testimony will be introduced to the fact that the least towing is done at San Pedro.

The approach to San Pedro is freer from danger than Santa Monica on account of

less fog. I file with you Exhibit No. 3, being fog and wind records kept at the custom-houses at San Pedro and Santa Monica since last June. This period covers the fog months as given on the pilot charts before referred to.

A summary of these fog observations is as follows:

	Days.
Total number of days compared.....	154
Fog at San Pedro on (14.3 per cent of 154).....	22
Fog at Santa Monica on (23.4 per cent of 154).....	36

Minimum duration of fog, two hours at San Pedro; one and one-half hours at Santa Monica.

Maximum duration of fog, nine and one-half hours at San Pedro; fifteen hours at Santa Monica.

Mean duration of fog, five hours and twenty-seven minutes at San Pedro; six hours and nine minutes at Santa Monica.

Total fog at San Pedro, one hundred and twenty hours.

Total fog at Santa Monica, two hundred and twenty-one and one-half hours.

The ratio of fog at San Pedro to fog at Santa Monica being as 100 to 184.6.

The cost of blowing out of the water the rock over which the bell buoy rides at San Pedro could probably be taken care of within the appropriation of \$2,900,000.

The excellent quality of the holding ground at San Pedro has been admitted. I desire, however, to draw attention to the point that in a harbor vessels generally moor, the protected area being usually too valuable to allow vessels to swing at their anchors.

The advocates of Santa Monica have given an important place to the slope of the sea bottom in front of their proposed breakwater. The true application of the theory depends upon a knowledge of the depth at which the waves at the location under consideration begin to be affected by the bottom. Without actual measurements of the characteristics of the waves it is not possible to do more than approximate what this depth may be.

Assuming as a possible thing the waves to be 12 feet high, with a proportionate length of 225 feet, and applying the generally accepted trochoidal theory of deep-sea waves, such a wave could not feel the bottom at a greater depth than 30 fathoms. At that depth the subtrochoid would have a height of 1 inch, which is practically nothing. With 12-foot waves, therefore, the only part of the sea bottom that can have import is from the 30-fathom curve into shore. I notice from Mr. Corthell's profile that the bottom slope at the two places is essentially the same between these limits.

While it is only possible to surmise as to the effect the bottom may have on the waves, we have facts as to the effect of the waves on the bottom, as shown by the bottom itself. I ask your attention to the level assumed by mud at both places and refer to the paper on "Tides and Coast Works" by the eminent harbor engineer, Thomas Stevenson, read before the Institution of Civil Engineers in April, 1888. In this paper Mr. Stevenson says there is "a feature which will be found of very considerable value in judging of the exposure of a coast. This is the level below the surface of low water at which mud reposes on the bottom. Though at first sight it might appear unlikely that the disturbance of the sea level by wind waves would be propagated to great depths, there are numerous facts which prove the contrary. Although the absence of mud in any locality proves nothing, because the tide currents may sweep it away or the geological formation may not produce it, yet its presence seems both a delicate and certain test of the lowest limit to which the disturbance originating at the surface has reached. Thus as the waves progressively decrease in magnitude in the North Sea between Shetland and the coasts of the Continent, the level of repose of mud progressively rises nearer the surface from a depth of 80 or 90 fathoms to only 8 fathoms at the mouth of the Elbe and to 12 fathoms off the coast of Holland, where ships can take the open beach in nearly all weathers without any protective harbors. If, therefore, we find in front of a proposed harbor or coastwork that mud reposes within a few fathoms of the surface, I believe we have in that fact certain ground for concluding that our works will never be assailed by a very heavy sea."

Gentlemen, the charts show the mud in front of San Pedro Harbor, close to the breakwater site of 1892, to lie in 8 fathoms of water, and according to the high authority quoted this is proof of no heavy seas.

I ask your attention to the small size of the rock forming the jetties at San Pedro as being good additional evidence on this subject.

In a paper advocating San Pedro read by me in 1895 before the Engineers and Architects' Association of Southern California, I expressed the opinion that the breakwater as designed by the Board of 1892 would intercept the shore currents and cause shoaling. This opinion was based upon the statement of the Board that at the southern end of Santa Monica Bay a well-marked current ran to the north and

west, and the observation that the groin north of Deadmans Island had accumulated sand on its north face. It is true that on the other hand there was evidence that material from San Pedro washed ashore at Long Beach; still the preponderance of evidence in my possession at that time favored the assumption that the sand moved north, and I drew my conclusions accordingly. During the last four months it has come to my notice that the sand on the north face of the before-mentioned groin was disappearing, together with the beach in front of the single work at the north end of Rattlesnake Island, and that the sand on the south face of the groin was apparently increasing. This was the opposite of what would occur with a north and west sand movement, and set me to thinking that it would be better to see what the sand actually did do than draw conclusions from a current that after all might have nothing to do with the movement. Accordingly I commenced a study of the beach itself, with the following results:

Commencing at the long wharf at Santa Monica there are indications that sand is accumulating on the west side of its junction with the shore.

At Ballona a sand spit has worked down from the west, pushing the outlet of the stream eastward until further movement has been stopped by the bluff.

The bar at the entrance to the inner harbor at San Pedro hooks round to the east. The early work of the coast surveys, platted on a scale of 1:10,000, shows that prior to any harbor improvements the sand spits near Deadmans Island pointed to the east.

The outlet of the Los Angeles River has been pushed toward Long Beach by the growth of the western spit until the Terminal Railway Company has had to resort to diking to arrest further movement.

The outlet of the San Gabriel River at Alamitos Bay has been pushed eastward until further movement has been arrested by clay banks.

At Anaheim Landing the first impression is that the sand dunes have grown from the south. Examination shows that the outlet channel is in clay and has not sensibly changed since the surveys of 1875. It is possible that the same clay underlies the sand dunes, which are high compared with those nearer Long Beach, and are the effect of wind. The western sands at the outlet of the creek hook to the south and east. The same remarks apply to Bolsa Creek.

At Newport the Santa Ana River has been pushed southward down the coast for nearly 8 miles.

At False Bay, north of San Diego, the stream has been pushed southerly until the bluffs have stopped further movement in that direction. Coronado Beach, under the lee of Point Loma, seems a parallel to Rattlesnake Island, under Point Firmin.

With these realities before me I can no longer believe in a movement to the north and west, or in any conclusions based on that theory.

Major Symons, on Littoral Currents, has been quoted. I will read from a paper by, I believe, the same gentleman:

"Referring again to my paper, some quotations have been made from it on the subject of railroads on the west side of San Pedro, but as the statements quoted have special reference to a particular design of breakwater, they are immaterial to the selection of the best harbor site, however pertinent they might be to the selection of the best breakwater."

The method of computing protected areas by projecting in the direction of the swell a line past each end of a breakwater is very misleading, unless it is always borne in mind that this area does not by any means represent still water. The waves swing around the ends of a breakwater through quite an appreciable angle without any sensible diminution of height or force, and even after they have spread and reduced very materially they still cause a lumpy water that would render it uncomfortable for vessels lying at a wharf. This is particularly so where the waves from the two ends meet, and is an objectionable feature of detached breakwaters. I desire to indorse Major Raymond's opinion expressed before the Senate committee, "that river and harbor engineers generally would consider a breakwater parallel to a rectilinear shore in the manner proposed to be defective," and like him I do not know of a harbor so constructed. I do not find among the 33 breakwater cases submitted by Mr. Corthell a single instance that is a parallel case to the Santa Monica proposition. The plans will speak for themselves, whether I am right or wrong. Take Cherbourg, for instance; there is nothing whatever in common between that plan and the proposed shelter at Santa Monica, except the detached breakwater.

Cherbourg Harbor consists of an outer harbor of refuge, a naval station, and a commercial inner harbor and docks, an arrangement for which San Pedro is most admirably adapted.

Take Plymouth as another instance, a harbor with which I am familiar. The breakwater stretches nearly across a bay between headlands, a superior proposition to Santa Monica, and I know that you sometimes get a very lumpy sea behind that breakwater from the waves that whip around the ends, and I desire to draw your

attention to the secondary breakwater built off from Mount Batten to protect Plymouth against these waves.

In regard to Mr. Corthell's reference to Harcourt's work on Harbors and Docks, a work which you undoubtedly have, commencing on page 80, the one referred to, I will ask you to read all that chapter. It is entitled "Peculiar types of harbors with detached breakwaters." All these peculiar types have end protection, the Santa Monica proposition has none.

In point of "fetch," seas from south-southeast have a clear sweep between San Pedro and Catalina to the site of the proposed harbor at Santa Monica, they would flank the breakwater, most seriously disturb the area between it and the shore, and the "racers" that have been so graphically described would rush along the breakwater face.

More could be said in support of the superiority of San Pedro and its admirable fitness for a completely protected front harbor for refuge and naval purposes, with a deep-water harbor behind well adapted to the necessities and conveniences of commerce, and unrestricted as to ingress, egress, or future development; but I think it unnecessary to occupy much more of your time and will conclude with some remarks upon the question of harbor of refuge.

A harbor of refuge is a shelter from one of three things or from a combination of them. First, a refuge to seek repairs from damage by storm or accident; second, a refuge from stress of weather; third, a refuge from stress of war.

The last phase I have already commented upon. As to the first, Santa Monica can be no refuge as there can be no docks at that location. As to the third and to all three cases, safety of approach is the one thing essential above all others.

San Pedro is at a salient point, and lies under the lee of high land. Santa Monica is deeply embayed, and forms a lee shore to the prevailing winds.

The approach to a salient point is safer in storm than the entering of a bay. On this subject I quote Thomas Stevenson, whose argument is both clear and forcible. He says: "The true situation for a harbor of refuge is rather upon a salient than on an embayed part of the line of coast; because, first, a salient part of the coast will lie nearer to the line of the general passing trade than a reentrant part; and, second, vessels seeking a haven and failing to make it will not find themselves embayed, but be still well to windward and have sea room to bear away for more distant haven on either hand. There is indeed a sense in which a harbor of refuge in the bottom of a bight may be regarded as a source of danger instead of a source of safety. Cardigan Bay, in Wales, for example, is just such a place as might perhaps be selected. But though a harbor in Cardigan Bay might in exceptional cases do good, it would be dearly purchased if the presence of the harbor tempted masters to leave a track of safety and unnecessarily to embay themselves. It will, I think, be generally admitted that if from fog a vessel failed to pick up the position of the harbor in the bay, there would be hardly a chance of her escaping shipwreck. A harbor of refuge on this principle is either kill or cure, for it offers one chance to the distressed vessel, which she must seek at the coast of embayment; but a harbor of refuge on a salient part of the coast offers a chance of shelter without necessarily compromising the safety of the ship in case she fails to make it."

I have not taken up the subject of plans or methods of construction because I understand it to be your wish to first decide the question of location upon general merits, but should it be desired to enter upon questions of construction I shall be glad to prepare the necessary documents showing that the San Pedro site can be brought within the limits of the appropriation and fulfill the conditions of a deep-water commercial harbor and a harbor of refuge.

Weather report, Santa Monica, Cal.

WEEK ENDING JUNE 6, 1896.

Date.	Wind.				Fog.	
	8 a. m.		5 p. m.		Time of setting in—	Time of clearing.
	Direction.	Force.	Direction.	Force.		
May 31.....	S.	Light.....	SW.	Fresh.....	A. M., clear...	P. M., clear.
June 1.....	S.	do.....	W.	Moderate...	A. M., cloudy.	Do.
June 2.....	SW.	do.....	W.	Light.....	do.....	Do.
June 3.....	S.	do.....	W.	Fresh.....	do.....	Do.
June 4.....	S.	do.....	SW.	Light.....	A. M., clear...	Do.
June 5.....	SE.	do.....	SW.	Moderate...	do.....	Do.
June 6.....	E.	do.....	SW.	Light.....	A. M., cloudy.	Do.

DEEP-WATER HARBOR.

227

Weather report, Santa Monica, Cal.—Continued.

WEEK ENDING JUNE 13, 1896.

Date.	Wind.				Fog.	
	8 a. m.		5 p. m.		Time of setting in—	Time of clearing.
	Direction.	Force.	Direction.	Force.		
June 7.....	E.	Light.....	SW.	Light.....	6 a. m.	9 a. m.
June 8.....	SW.	do.....	SW.	Fresh.....		
June 9.....	W.	do.....	SW.	Light.....		
June 10.....	S.	Calm.....	SW.	do.....		
June 11.....	S.	Light.....	SW.	do.....		
June 12.....	SW.	do.....	SW.	do.....		
June 13.....	S.	Calm.....	SW.	Moderate.....		

WEEK ENDING JUNE 20, 1896.

June 14.....	S.	Light.....	SW.	Light.....	8 a. m.	11 a. m.
June 15.....	E.	do.....	SW.	do.....	A. M., cloudy.	P. M., clear.
June 16.....	SW.	do.....	W.	Moderate.....	6 a. M.	10 a. m.
June 17.....	W.	do.....	W.	Light.....	do.....	12 m.
June 18.....	E.	Moderate.....	W.	Fresh.....	A. M., clear.....	P. M., clear.
June 19.....	SW.	Light.....	SW.	do.....	do.....	Do.
June 20.....	S.	Calm.....	SW.	do.....	do.....	Do.

WEEK ENDING JUNE 27, 1896.

June 21.....	S.	Light.....	SW.	Fresh.....	A. M., cloudy.	P. M., clear.
June 22.....	E.	do.....	SW.	do.....	do.....	P. M., cloudy.
June 23.....	E.	do.....	SW.	Moderate.....	do.....	P. M., clear.
June 24.....	E.	do.....	SW.	Light.....	do.....	P. M., cloudy.
June 25.....	S.	Calm.....	SW.	Fresh.....	do.....	P. M., clear.
June 26.....	SW.	Moderate.....	W.	do.....	do.....	Do.
June 27.....	S.	Light.....	SW.	do.....	do.....	Do.

WEEK ENDING JULY 4, 1896.

June 28.....	S.	Light.....	W.	Fresh.....	A. M., clear.....	P. M., clear.
June 29.....	E.	do.....	W.	do.....	A. M., cloudy.	Do.
June 30.....	S.	do.....	SW.	do.....	A. M., clear.....	Do.
July 1.....	E.	do.....	SW.	do.....	A. M., cloudy.	Do.
July 2.....	SE.	do.....	SW.	do.....	do.....	Do.
July 3.....	S.	do.....	W.	do.....	do.....	Do.
July 4.....	SE.	do.....	SW.	Moderate.....	do.....	P. M., cloudy.

WEEK ENDING JULY 11, 1896.

July 5.....	S.	Light.....	SW.	Fresh.....	A. M., cloudy.	P. M., cloudy.
July 6.....	E.	do.....	W.	do.....	do.....	Do.
July 7.....	SW.	do.....	SW.	Moderate.....	do.....	Do.
July 8.....	SE.	Calm.....	W.	Fresh.....	do.....	P. M., clear.
July 9.....	SW.	Light.....	SW.	Moderate.....	do.....	Do.
July 10.....	SW.	do.....	W.	Light.....	A. M., clear.....	Do.
July 11.....	SW.	do.....	SW.	Moderate.....	A. M., cloudy.	Do.

WEEK ENDING JULY 18, 1896.

July 12.....	S.	Light.....	W.	Light.....	A. M., cloudy.	P. M., clear.
July 13.....	SW.	do.....	W.	do.....	10 a. m.	2 p. m.
July 14.....	S.	do.....	SW.	do.....	6 a. m.	10 a. m.
July 15.....	SW.	do.....	W.	Fresh.....	A. M., clear.....	P. M., clear.
July 16.....	SW.	do.....	SW.	Moderate.....	do.....	Do.
July 17.....	S.	do.....	W.	Fresh.....	do.....	Do.
July 18.....	S.	do.....	W.	do.....	do.....	Do.

DEEP-WATER HARBOR.

Weather report, Santa Monica, Cal.—Continued.

WEEK ENDING JULY 25, 1896.

Date.	Wind.				Fog.	
	8 a. m.		5 p. m.		Time of setting in—	Time of clearing.
	Direction.	Force.	Direction.	Force.		
July 19	S.	Light.	W.	Fresh.	A. M., cloudy.	P. M., clear.
July 20	SW.	do	SW.	do	A. M., clear.	Do.
July 21	SE.	do	SW.	Moderate.	A. M., cloudy.	P. M., cloudy.
July 22	S.	do	W.	Fresh.	do	P. M., clear.
July 23	S.	do	SW.	do	do	Do.
July 24	S.	do	SW.	Moderate.	do	Do.
July 25	S.	Calm.	W.	Fresh.	do	Do.

WEEK ENDING AUGUST 8, 1896.

August 2	SE.	Light.	SW.	Light.	5 p. m.	8 p. m.
August 3	S.	do	W.	Fresh.		
August 4	SE.	do	W.	do		
August 5	SE.	do	SW.	do		
August 6	S.	Calm.	W.	do		
August 7	S.	Light.	W.	do	2 a. m.	8 a. m.
August 8	SW.	do	W.	do	4 a. m.	Do.

WEEK ENDING AUGUST 15, 1896.

August 9	S.	Light.	W.	Fresh.	2 a. m.	5 a. m.
August 10	E.	do	W.	do		
August 11	SE.	Moderate.	W.	do		
August 12	S.	Light.	SW.	do		
August 13	SW.	do	W.	do		
August 14	SE.	do	W.	Moderate.	7.30 a. m.	10 a. m.
August 15	S.	do	SW.	Light.		

WEEK ENDING AUGUST 22, 1896.

August 16	S.	Light.	NW.	Moderate.	Raining a. m.	11 a. m.
August 17	SE.	do	W.	Fresh.		
August 18	SW.	do	W.	do		
August 19	SW.	do	W.	do		
August 20	SW.	Moderate.	W.	do	8 a. m.	
August 21	SW.	Light.	SW.	Light.		
August 22	SW.	do	SW.	do		

WEEK ENDING AUGUST 29, 1896.

August 23	S.	Light.	SW.	Light.		
August 24	W.	do	W.	do		
August 25	SW.	do	SW.	do	7 a. m.	10 a. m.
August 26	SW.	do	SW.	do	5 a. m.	10 a. m.
August 27	SW.	do	SW.	do		
August 28	SW.	do	SW.	do		
August 29	SW.	do	SW.	do		

WEEK ENDING SEPTEMBER 5, 1896.

August 30	S.	Calm.	W.	Moderate.		
August 31	SW.	do	SW.	Fresh.		
September 1	E.	Moderate.	W.	Moderate.	8 p. m.	12 m.
September 2	SE.	Light.	SW.	Fresh.	5 a. m.	9 a. m.
September 3	S.	do	SW.	do	6 p. m.	12 m.
September 4	S.	do	W.	do	7 p. m.	12 m.
September 5	SW.	do	W.	Moderate.		

Weather report, Santa Monica, Cal.—Continued.

WEEK ENDING SEPTEMBER 12, 1896.

Date.	Wind.				Fog.	
	8 a. m.		5 p. m.		Time of setting in—	Time of clearing.
	Direction.	Force.	Direction.	Force.		
September 6.....	SW.	Light.....	SW.	Moderate.	10 a. m.....	11.30 a. m.
September 7.....	SW.	do.....	W.	Fresh.....		
September 8.....	W.	Moderate.	W.	do.....		
September 9.....	S.	Light.....	W.	do.....		
September 10.....	S.	do.....	SW.	do.....		
September 11.....	SE.	do.....	W.	do.....	2 a. m.....	8 a. m.
September 12.....	E.	do.....	SW.	Moderate.		

WEEK ENDING SEPTEMBER 19, 1896.

September 13.....	S.	Light.....	SW.	Moderate.		
September 14.....	SE.	do.....	W.	Fresh.....	3 a. m.....	11 a. m.
September 15.....	S.	Calm.....	W.	Moderate.		
September 16.....	SE.	do.....	SW.	Light.....		
September 17.....	E.	Light.....	W.	Moderate.	4 a. m.....	10 a. m.
September 18.....	SE.	Moderate.	W.	Fresh.....		
September 19.....	S.	Light.....	W.	Light.....		

WEEK ENDING SEPTEMBER 26, 1896.

September 20.....	SE.	Light.....	W.	Moderate.		
September 21.....	S.	Moderate.	W.	Fresh.....		
September 22.....	E.	do.....	SW.	Moderate.		
September 23.....	NE.	Calm.....	SW.	Light.....		
September 24.....	S.	Light.....	W.	Moderate.		
September 25.....	SE.	do.....	SW.	Light.....	11 a. m.....	2 p. m.
September 26.....	E.	do.....	W.	do.....	1 a. m.....	10 a. m.

WEEK ENDING OCTOBER 3, 1896.

September 27.....	NE.	Light.....	W.	Moderate.		
September 28.....	E.	Moderate.	W.	Fresh.....	1 a. m.....	8 a. m.
September 29.....	SE.	Light.....	SW.	do.....		
September 30.....	E.	do.....	SW.	do.....		
October 1.....	S.	do.....	W.	do.....	10 p. m. of 1st.	1 p. m. of 2d.
October 2.....	E.	Calm.....	W.	Light.....	9 p. m. of 2d.	11 a. m. of 3d.
October 3.....	NE.	do.....	SW.	do.....	7 p. m. of 3d.	Midnight.

WEEK ENDING OCTOBER 10, 1896.

October 4.....	S.	Light.....	SW.	Light.....	Midnight of 3d.	10 a. m. of 4th.
October 5.....	NE.	Calm.....	W.	Moderate.	9 p. m. of 4th.	10 a. m. of 5th.
October 6.....	SW.	Light.....	W.	Fresh.....	1 a. m.....	10 a. m.
October 7.....	SW.	do.....	SW.	Moderate.	12.30 a. m.....	9 a. m.
October 8.....	S.	do.....	SW.	Light.....	9 p. m. of 7th.	8 a. m. of 8th.
October 9.....	E.	Calm.....	SW.	do.....	12.30 a. m.....	10 a. m.
October 10.....	E.	Light.....	SW.	do.....	4 a. m.....	Do.

WEEK ENDING OCTOBER 17, 1896.

October 11.....	E.	Light.....	SW.	Light.....		
October 12.....	E.	do.....	W.	Fresh.....		
October 13.....	SE.	do.....	W.	do.....		
October 14.....	S.	Calm.....	SW.	Moderate.		
October 15.....	S.	do.....	W.	Light.....		
October 16.....	N.	Moderate.	W.	do.....		
October 17.....	E.	Calm.....	W.	Fresh.....		

Weather report, Santa Monica, Cal.—Continued.

WEEK ENDING OCTOBER 24, 1896.

Date.	Wind.				Fog.	
	8 a. m.		5 p. m.		Time of setting in—	Time of clearing.
	Direction.	Force.	Direction.	Force.		
October 18	SE.	Light.....	W.	Light.....		
October 19	S.	Calm.....	SW.	do.....		
October 20	NE.	Moderate.....	SW.	do.....		
October 21	E.	Light.....	SW.	Moderate.....		
October 22	NE.	Moderate.....	W.	Light.....		
October 23	SE.	Light.....	SW.	Moderate.....		
October 24	E.	do.....	SW.	do.....		

WEEK ENDING OCTOBER 31, 1896.

October 25	SW.	Moderate.....	W.	Moderate.....		
October 26	S.	Light.....	W.	Fresh.....		
October 27	SW.	Gale.....	W.	Gale.....	Rain, a. m.	
October 28	E.	Moderate.....	SW.	Light.....		
October 29	SE.	Light.....	SW.	do.....		
October 30	S.	do.....	SW.	do.....		
October 31	S.	Calm.....	SW.	do.....		

WEEK ENDING NOVEMBER 14, 1896.

November 8	E.	Light.....	SW.	Moderate.....		
November 9	E.	Moderate.....	SW.	Light.....		
November 10	NE.	do.....	SW.	do.....		
November 11	N.	Fresh.....	SW.	do.....		
November 12	SE.	Light.....	W.	do.....		
November 13	S.	do.....	SW.	do.....		
November 14	NE.	Calm.....	W.	do.....		

WEEK ENDING NOVEMBER 21, 1896.

November 15	S.	Light.....	SW.	Light.....		
November 16	SE.	do.....	W.	Moderate.....		
November 17	E.	do.....	W.	Fresh.....	8 a. m.....	11.30 a. m.
November 18	E.	Moderate.....	SW.	Moderate.....	5 a. m.....	10 a. m.
November 19	NE.	Light.....	SW.	Fresh.....		
November 20	NE.	Fresh.....	S.	Light.....		
November 21	SE.	Light.....	SW.	Fresh.....		

Remarks of Hon. George C. Perkins, of California, in the Senate of the United States, Tuesday, May 12, 1896.

The Senate having under consideration the bill for the improvement of rivers and harbors, which appropriated \$3,098,000 for a breakwater in Santa Monica Bay, Los Angeles, Cal.—

Mr. PERKINS said:

MR. PRESIDENT: The discussion has taken an exceedingly wide range. I thought I had some knowledge of the coast of California and of the wishes of the people of that State, but I must admit that I have been somewhat mystified by the discussion which has taken place during the past three or four days upon the floor of the Senate.

I find, in examining the report of the Committee on Commerce, that it gives evidence of great labor and great research, and contains a fund of information obtained by that committee, which is entitled to the thanks of the Senate and of the people of our country.

I notice that there are about 400 different appropriations made for the improvement of harbors, of rivers, of estuaries, and of lakes, and for the removal of bars at the entrance of harbors. I notice that these 400 appropriations are divided among 36 States of the Union, and that embraced in these appropriations are three great rivers, the Mississippi, the Missouri, and the Ohio.

I also find, in looking at the estimates made, that almost every one of the recommendations of the committee and every one of the proposed appropriations, with, perhaps, the single exception of the one now under discussion, was made upon the estimates and recommendations of the United States Government engineers. It would have been a herculean task—it would have been practically impossible—for the committee to have intelligently arrived at the various recommendations they have made without the report of the Government Corps of Engineers, who have been detailed for this purpose.

The chairman of the Committee on Commerce has a national reputation, well earned by twenty-five years' duty in Congress. He is perhaps as well equipped to perform the duties of that committee as any other Senator who ever held a seat on this floor. While I differ with him in his conclusions upon this proposition, yet he could hardly do anything which would dissipate the admiration I have for him for his advocacy in former years of our American shipping and his defense of American industries and American institutions. He is deserving of and has the thanks of the people of this country for his indefatigable energy and zeal in whatever he undertakes. He is a positive man, a man of force of character and determination; and it was unfortunate, perhaps, for the people of California that on his first visit to the Pacific Coast he went to Santa Monica, and there saw the beauties of that delightful place—for the town of Santa Monica and its surroundings are not excelled by any place in any State or any country in the world.

Yesterday, when I heard him picture in such glowing language the beauties of Santa Monica I asked my friend on the right, who accompanied him on that journey [Mr. Davis], what was the month of the year in which the visit was made. He informed me it was the month of November. I could then readily understand that one leaving Maine in November, with its bleak, cold, stormy coast, on which broke the angry waves of the Atlantic, leaving a crest of frozen spray wherever they dashed against the rocks, and going to Santa Monica, would be most deeply impressed with the place as he looked out upon the broad Pacific at that time of the year—the most delightful in California. That season of the year on the Pacific is what August and September are on the Atlantic. It is the Indian summer. The trade winds have ceased to blow and the angry Pacific, which has been bubbling and boiling during all the summer months, is as quiet as a mill pond in June in the Senator's native State. So I can understand, as he sat on the beach at Santa Monica and there heard the Pacific sing the sunset song of the nation as it washed the western shore of this continent, how he became enamored of Santa Monica, and that nothing that we can ever say or do will dispel his admiration. I might paraphrase a familiar couplet, and say:

And neither the angels in heaven above
Nor the demons down under the sea
Can disserve his love
From the love he bears—

For Santa Moni[ca]kee. [Laughter.]

Santa Monica will be a part of the city of Los Angeles, and perhaps many a Senator now upon this floor will at some time there find a delightful home.

The question before us for our consideration is a simple business proposition. California has a coast as long as the distance from Maine to South Carolina—that is, California borders the Pacific for the same distance that the States between Maine and South Carolina border the Atlantic. In the southern part of California there has grown up the great metropolis of Los Angeles—the city of angels. It is located in the midst of one of the richest agricultural, horticultural, and viticultural sections of the country. It has vast and illimitable commercial possibilities; it has undeveloped mining resources; it is the central depot of two great transcontinental railroads, and is their terminus on the western side of this continent—the Atchison, Topeka and Santa Fe Railroad and the Southern Pacific Railroad. The population of Los Angeles County has doubled every four years during the past two decades, and yet they come; and the people who come there never return except to visit their friends, for it is the paradise of this country. Its future I shall not attempt to describe, but it is as bright as the midday sun. The railroads I have named are reaching out into Arizona, into New Mexico, into Texas, into southern Utah and southern Nevada, and are bringing the wealth of those great States and Territories into that city.

So the people say, "We want a port of entry, a port of export for these great products." They came to Congress, and Congress assisted them in improving the harbor of Wilmington, at San Pedro, and never was money more judiciously expended or expended with better results than those derived from the Government appropriations made for that port. When they commenced the work in 1872 there was but 2 feet of water upon the bar at the entrance to that harbor; to-day there is 18 feet of water, and the appropriation proposed by the Committee on Commerce of \$492,000 will give us, we believe, 22 feet of water. If it does, the harbor is capable of being

enlarged and made a great commercial seaport—a harbor where there will be machine shops, graving docks, and all the appliances which are so necessary to foster and encourage a successful commerce.

I want to say, about the enterprise of the railroads which have come into Los Angeles, that it is their competition which has developed that country. It is competition we want in business, in the transportation business, in manufacturing and every other branch of commercial industry. We want that rivalry, that emulation, that energy which commends business people to their patrons. I want to say here that on this question there is no contest, as has been intimated, between two railroad companies, and I can not permit to pass unchallenged the remarks made by the Senator from Missouri [Mr. Vest] and by the Senator from Maine [Mr. Frye] yesterday. That I may not misquote them I shall read from the Record.

The Senator from Missouri said:

"Unfortunately, Mr. Huntington is a political factor in California. They test every man's competency and qualification for office there by the question, 'Is he for Huntington or against him?' You can not hold a town meeting but what the question is, 'Is this man a Huntington man or not a Huntington man?'"

Then the Senator from Maine said, referring to some remarks which had been made by my distinguished colleague [Mr. White]:

"This savors of the slogan of the sand lots of the Golden Gate, where the name of Huntington is conjured with to frighten babies, and used by demagogues to make weak-kneed politicians tremble."

Mr. President, I dislike exceedingly to refer on this floor to any gentleman who is not a member of this body. I dislike exceedingly to refer to anyone who is not here to speak and answer for himself. But I say that that charge is a libel upon the fair name of the good people of California, and I should be false to those I represent if I permitted the charge of the Senators from Maine and Missouri to pass unchallenged. The people of California have no prejudices against Mr. Huntington or his associates. I know nothing against Mr. Huntington to his discredit, unless it be his own testimony before a Congressional committee and certain letters which it is alleged he wrote to an associate upon the board of directors of the company with which he was connected. I have no feeling of personal animosity or jealousy or envy toward him; I admire him for his enterprise, for his pluck, for his energy; I admire him for what he has accomplished in his life. I knew him many years ago in California when he was an honored and respected merchant in that State. He left us to come East many years ago, and I do not know much of him, except through general report, since that time. But I repel the charge that the people of California seek office by declaiming against him or his associates, or by advocating that which he desires, or opposing it. The people of California are a cosmopolitan people. There are representatives of every State in this Union to-day resident in California. They have built up that great empire of the West. They are a broad-minded, liberal people in politics, in religion, and in their business pursuits. They have no such prejudices as are charged against them.

Mr. President, I have but to refer you to the fact that the president of that great corporation was elected governor of that State by the popular vote of the people; I have but to remind you of the fact that he was twice elected to a seat upon this floor. The crowning act of his life was performed before being called to that "bourn whence no traveler returns." He had the courage to become the executor of his own estate while living, and administered its affairs for the benefit of the people. He established a magnificent university of learning, where the humblest child in this land may go and drink from the fountain of knowledge without money and without price. His associates upon that board have been known for their acts of public spirit, of munificence, and of benevolence. The family of Mr. Crocker to-day, to my certain knowledge, are distributing thousands of dollars in charity; and many an old man and old woman, many a sick man and sick woman and helpless child, inmates of hospitals and homes founded through their munificence, can thank them for their humane sympathy and assistance.

Mr. President, the people of California, in city and county and State, gave most liberally toward building the first transcontinental railroad. They were in sympathy with the promoters, because the latter were in touch with the people at that time; and if to-day our people censure them, it is because they believe they have not been true to their trust; that they have forgotten the common interests and the common bond which unite their interests with the interests of the people of California. That is the reason. If they are censured it is because they use their great power sometimes to thwart the wishes and desires of the people; but that the name of Mr. Huntington is used to influence the acts of public men in California is untrue. I repeat it, it is a base slander against the good name and fame of the people of California.

Mr. President, only last week a great State convention met in California. There were in that convention representatives from every town and county in the State. They assembled at the capital, and among the various resolutions they passed was

one denouncing what is known as the railroad funding bill. But to show that they had no prejudice against the individual members of that company, except only as to their action in a corporate sense, they nominated for Presidential elector the vice-president of that great railroad company; and, as sure as the sun rises and sets on election day in November next, he will be elected a Presidential elector of the United States.

I did not intend to refer to this, but it has been called out by the charge made here—the unjust charge—that the names of certain men are made to play the part of the boggy man in California. The charge is without foundation; it is without one bit of truth.

We believe in railroads. We believe that they have the power to develop the great resources of our State as no other agency has. What we complain of is that they prostitute their power to elect to office men whom the people do not want; or that when men are elected to office they use their power to influence them to subserve private instead of public interests. All we want the railroad company to do, and what the people demand, is that it shall be equal before the law, equal before the people; that it shall pay its just quota of taxes and do as the humblest man in this land is compelled by law to do.

But, Mr. President, we are wandering away from this port of refuge, from this great commercial harbor, which the people of California have declared time and time again they want built on the coast. We have 75 miles alone on the coast of California fronting on the one county of Los Angeles, and comprised within that distance there is the great Santa Monica Bay and the great San Pedro Bay. Our Government has decided through two impartial Boards of Engineers, and also by a Board of the Coast and Geodetic Survey, in favor of San Pedro.

And what is the Coast and Geodetic Survey? What is its mission? In the year 1807 the United States Coast and Geodetic Survey was established by an act of Congress. In 1843 it was reorganized, and since that time it has been the greatest factor in our coast surveys, making the soundings of our harbors, making the triangular surveys of the coast, showing the elevation of the mountains and the location of sunken rocks and of hidden bars, light-houses, and beacons, and publishing sailing directions for the mariner.

Mr. STEWART. Will the Senator from California allow me to ask him a question?

Mr. PERKINS. Certainly.

Mr. STEWART. Do I understand the Senator to state that the Coast and Geodetic Survey have reported against Santa Monica?

Mr. PERKINS. Professor Davidson, who had charge of the Coast and Geodetic Survey, in a letter which my colleague presented, which has been published already and is of record, reported against Santa Monica as a suitable place for a harbor. I will read it if the Senator desires. It has, however, been printed in the Record; it appeared there in full this morning.

Mr. STEWART. Captain Taylor had charge of the surveys at that time. We have his letter.

Mr. PERKINS. Captain Taylor was a subordinate under the direction of Professor Davidson. I state it as a fact, which came to my knowledge through a captain of one of the coasting vessels, that while he was engaged in making soundings in Santa Monica Bay a strong southwest gale of wind came on and he was obliged to run his vessel under the lee of the Island of Catalina for protection. In a letter dated January 19, 1876, on file in the office of the Coast and Geodetic Survey in this city, Captain Taylor says of the proposed site for a deep-water harbor:

"High winds do not get home here with any violence, but the heavy swells do. The swell, owing to Santa Monica being at the head of the bight, does not vary in its direction, however it may be rolling outside, and the wharf has to be built head on. * * * The heavy swell prevents it having any of the qualities of a harbor proper except by means of an artificial improvement."

Mr. President, to the Coast and Geodetic Survey we are indebted for our charts of our coast. The chart before us and other charts upon the desks of Senators were made by them. We are indebted to them for the Coast Pilot. The last issue was published in 1889. It gives the sailing directions of the vessels making the different ports upon the coast. It gives the altitude of the different light-houses, the class of light-houses, whether they are stationary, revolving, or flash light, and all other directions so necessary to the safe and successful navigation of the coast. Since my friend from Nevada has referred to it, I will, with your permission, read what the Coast Pilot says of Santa Monica Bay:

"From Point Vincente to Point Dume the course is north 67 degrees west, and the distance 25½ miles. The space inside this course is called Santa Monica Bay, and the deepest part is abreast the Arroyo Santa Monica, which is 10 miles north of the above line.

"General hydrography of the bay.—From Point Vincente the cliffs to the northwest trend north 37 degrees west for 2½ miles to the westernmost termination of the ridge, which is called Rocky Point (described on page 47), and thence nearly north-northeast

for 3 miles to the long sand beach forming the eastern shore of Santa Monica Bay. The northern shore lies at the base of the high, rugged mountains of the Santa Monica Range. The beach is only passable at low water. The whole force of the western swell breaks heavily against these cliffs. The depth throughout the bay is quite irregular. Abreast of the arroyo and town of Santa Monica a depth of 40 fathoms is found 4 miles off shore, but off the beach, between La Ballona and the salt pond, a submarine plateau 4 miles wide stretches out to the southwest for 8 miles, with very uniformly decreasing depths, to 40 fathoms, with gray sand, mud, and gravel. Westward of this plateau and toward Point Dume the depth increases rapidly to nearly 300 fathoms, muddy bottom, and carrying 200 fathoms within a mile south of the point. On the east of this plateau, and toward Point Vincente, there is a remarkable submarine valley only 1 mile wide, between the 100-fathom curves, and carrying from 280 fathoms, muddy bottom, to 100 fathoms within $1\frac{1}{2}$ miles of the beach, near the salt works. The eastern side of this valley is remarkably steep, dropping from 40 to 200 fathoms in three-eighths of a mile. The western side is more sloping, but the slope from 100 fathoms is very sharp."

Ranging off from each one of these points or headlands—Point Dume, Point Vincente, and Point Firmin—there is a great suboceanic valley, as it were. As was shown by the letter from Professor Davidson presented here in my colleague's speech, the water pitches off abruptly from a depth of 6 to 8 fathoms to over 150 fathoms. This is not confined alone to Point Firmin or Point Vincente or San Pedro, but to Point Dume and to almost all the places where promontories reach out into the ocean. Therefore the charts other than those issued by the Coast Survey and presented here may easily deceive the eye.

I want to say, in passing, that Engineer Hood and Engineer Corthell stand high in their profession. They are perhaps as eminent as any we know of in that eminent calling. But they are not looking for defects in the harbor of Santa Monica. They are employed as special counsel, as special experts, to show the advantages of that particular locality as compared with the other locality. While the Senator from Maine stated that Mr. Corthell had made a careful survey of the harbor and the soundings, I hardly think he spoke advisedly, because from his own testimony it was impossible for him to do this in the time he was on the Pacific Coast. The survey alone of such a bay as Santa Monica or San Pedro would take a vessel, with her complete crew and a corps of engineers who are adepts and experts in that line, at least six months. It is done by triangulation. Every 100 square yards off shore is sounded and the character of the ocean floor is depicted in the same way as the general topography of the country is shown on a map. It is a labor of months and years before a perfect and careful survey can be made and the rocks and reefs of the locality noted. When a company is about to build a wharf they spend weeks and weeks in selecting a location for that particular wharf. How must it be when it is necessary to survey an area of 50, 75, or 100 square miles? I am confident that the Senator from Maine must have been misinformed as to Mr. Corthell's knowledge of the bottom of this bay. It is not in the power of man to gain such knowledge in the length of time that this eminent engineer devoted to the study of Santa Monica Bay.

Now, coming back to the location, what is the sentiment of the people of Los Angeles? Public sentiment, the Senator from Maine says, has nothing to do with the locality of a wharf; it has nothing to do with the place where a harbor should be. The people, he says, have nothing to do with the location, that it belongs to the Government, but he is willing that a self-constituted committee of Congress shall make the selection. In other words, we will prescribe the medicine and let the people take it.

Mr. President, who are "we"? We are simply the temporary agents the people sent here for a particular purpose, sent here to represent them on certain lines of duty. Some of these lines they have indicated in language that is unmistakable, others they leave to our discretion. The representative who is not true to the instructions given, the representative who does not carry out both in spirit and letter the well-known wishes of his constituents, is not only false to them and false to himself, but he is unworthy to be their representative.

Two years ago when the political campaign was made the universal voice and sentiment in Los Angeles was for San Pedro; and why? It was because a Board of Government Engineers had declared it the best, the most feasible, the most practicable place, and so the legislature of California, through their representatives, passed a resolution. I will try not to travel over any of the beaten ground which my colleague has so well covered, but to this resolution I think he did not refer, and therefore I will read it:

"Senate joint resolution No. 15, relating to the construction by the United States Government of a deep-water harbor at San Pedro, on the coast of Los Angeles County. (Adopted February 8, 1893.)

"Whereas the Board of Engineers appointed by the Secretary of War to inquire into and report upon the best point for the construction by the United States Government of a deep-water harbor on the coast of southern California and the necessities

for such work have reported in favor of San Pedro, on the coast of Los Angeles County, and also in favor of the necessity of such harbor being constructed; and
 "Whereas it will afford greatly needed facilities for ocean commerce to a large section of this State: Therefore,

"Be it resolved by the senate of the State of California (the assembly thereof concurring), That we instruct our Senators, and urgently request our Representatives in Congress from this State, that they use every means in their power to secure, at the session of Congress now in session, the passage of a bill appropriating the sum of at least \$500,000, to begin the construction of such a deep-water harbor at San Pedro on the seacoast of Los Angeles County, in this State, as is contemplated in the report of the Board of Engineers hereinbefore referred to; and

"Be it resolved, That the governor be requested to transmit to each of our Senators and Representatives in Congress from this State a copy of these resolutions."

That is the last expression of the people of California through their representatives in the State legislature.

Mr. STEWART. I inquire of the Senator if he has heard that senators and representatives who voted for that resolution have changed their views upon this same question?

Mr. PERKINS. Not in their official capacity. A few of those who thus performed their duty publicly have privately advised their Representatives that they would be glad to have them vote for Santa Monica.

Mr. STEWART. How many who voted for the Senator are among those?

Mr. PERKINS. The Senator is entitled to a fair answer and he shall receive it.

Mr. STEWART. All right.

Mr. PERKINS. In the county of Los Angeles six or seven representatives in the legislature who voted for me (that is a high encomium on their good judgment) have since wired me that they would be glad to have me vote for two appropriations, one for Santa Monica and the other for San Pedro. But that was done as private individuals, not as representatives of the people of the State in the legislature. They acted simply as individuals, at the impertunity perhaps of some official friends, and being, as they must have been, amiable gentlemen, or I would not have received their votes, they desired to please them, knowing, as they did, that I have never yet swerved from my public duty as I understood it. I promised them before I was elected that I would carry out the wishes of their people on this particular question as expressed through my colleague [Mr. White], the Senator who lives in their city, and through their Congressman, who lives in that city, and when a vote on the pending question is taken I shall do my duty as I understand it to be.

But since our legislature adjourned there has been another great assemblage, the eighth convention of the Trans-Mississippi Commercial Congress. This convention met in Omaha, Nebr., on the 25th of November, 1895, and continued in session until the 28th. It had representatives from 26 different States and Territories. They assembled there, having in view the best commercial interests of this country. Representatives from 26 States went there without the hope or fear of reward. They went there having in view only that which they believed would best advance the interests of our whole country. I notice that the State of Missouri had some 30 or 40 representatives in that convention, as appears from their proceedings. Among the resolutions which they adopted was the following:

"Resolved, That the Congress of the United States be urged to provide for the construction of a deep-water harbor at San Pedro as already determined by the several acts of Congress, and in accordance with the several recommendations of the Boards of United States Army Engineers (as shown by Executive Documents Nos. 39 and 41 of the Fifty-second Congress, first and second sessions), and that the further improvement of the interior harbor at San Pedro be earnestly recommended."

I do not see how my friend from Missouri can do otherwise than vote for the appropriation for San Pedro, for I think Missouri was more largely represented in the convention, unless perhaps Nebraska, than any other State of the Union.

Mr. President, I have only referred to this as showing the public sentiment as expressed through the people in Los Angeles, which is the home of my distinguished colleague. Then we have the report of the Government engineers. If there were no other reason, I can not see how I could honestly perform my duty and vote on this question contrary to their recommendations. They are men of well-known integrity and high character. During the past ninety years, I think, since the Government first undertook the improvements of harbors and the building of fortifications and light-houses, the work has been delegated to the Corps of Engineers of the United States Army, and to their credit be it said, out of the hundred of millions of dollars which they have expended there has never been the taint of scandal connected with the disbursement of these immense sums of money. Holding their position for life or during good behavior, educated by the Government, they feel that patriotism and pride in their profession which have held them strictly to their line of duty. How could they then make an exception in this one particular case? I know the chairman of the first Commission well and intimately, Col. G. H. Mendell,

for forty-five years an honored army officer and chief of the Corps of Engineers on the Pacific Coast. He has no prejudice surely against any company or individual. He has no bias in favor of any particular place. You might as well charge a skillful surgeon called in to diagnose a disease with being biased or prejudiced. If he is true to his profession, true to his duty, he knows nothing but the subject that is before him, and he makes his finding according to the facts. So it is with these gentlemen.

As I have stated, and it is the one bright page in the history of our public men, this splendid Corps of Engineers, educated at our great institution of learning at West Point, supported by the Government, have always been honest and loyal to duty. They hold their position for life, and there is no influence that can prevent them from doing their duty. They can only be removed by impeachment, and impeachment can never lie against an honest man. So they have again and again reported in favor of the improvement of an outer harbor at San Pedro in preference to Santa Monica. They reported in favor of Wilmington, and I believe the Wilmington Harbor yet will become the great central shipping basin of southern California.

I remember that when a boy, many years ago, I visited Newcastle-upon-Tyne. At low tide there was scarcely any water in that river, and yet to-day for miles, tens of miles along that stream there are great shipbuilding yards, great graving docks, machine shops, and foundries, where they are turning out five great steamships a day. It was the skill of man that widened those rivers and gave them a depth of water that to-day enables great ships to sail to and fro, carrying immense cargoes of coal and iron.

In conversation a few weeks ago with a very intelligent Scotchman who was born in Edinburgh he said: "When a boy, 3 miles below the city of Edinburgh I frequently waded across that little stream, which, as you know, is an estuary of the sea, and it is called the Frith of Forth, and yet to-day great steamships drawing 26 and 27 feet ply their vocation up and down that river." So I believe this is all possible for Wilmington in the future.

But there has been one strong point made in favor of Santa Monica, and it has not been answered yet. Why did the Southern Pacific Railroad, it is asked, abandon Wilmington, where they had expended millions of dollars, and go to an unknown place and there build a wharf costing them nine hundred thousand or a million dollars? The mere statement of that question carries with it a strong argument, and if the facts were true it would be almost unanswerable. But, Mr. President, they are not true. They have not abandoned San Pedro or Wilmington, and I do not believe there is any reasonable amount of money that could purchase their rights there.

Mr. STEWART. Have they not abandoned their scheme to build a wharf in the outer harbor?

Mr. PERKINS. Yes; and I will tell you why. I will come to that in one second. They never seriously intended building a wharf outside until the breakwater was completed, because they had ample facilities inside for the transportation of all the freight that came there. The great objection to it was lighterage. It was one of the great expenses that ships having a heavy draft of water—more than 18 feet—could not go in over the bar at Wilmington, and the result was that the ships were obliged to anchor in San Pedro roadstead and there lighter their coal on shore. So there was a rival wharf built at a place called Redondo, on the southern portion of Santa Monica Bay, and that wharf was getting a large amount of business that came from the north, because passengers and freight would reach Los Angeles City via Redondo several hours before they could on vessels coming from the north going via San Pedro. It was a wise business undertaking, and it is characteristic of the enterprise and sagacity and the business foresight of the management of that great railroad company. As I have said before, for his enterprise, for his energy, for his push, Mr. Huntington is the peer of any man in this country. So he wisely said, "We will build a wharf on this bay where we can save this lighterage." Do you know that they use from ten to fifteen thousand tons of coal per month that is obliged to go over their road to the various distribution depots? So the railroad company decided to build this wharf at Santa Monica, and saved this dollar a ton lighterage which it was paying to another company. It was a wise business enterprise. It was not an experiment.

To hear my friend from Maine talk, anyone would think Santa Monica is the only place for a wharf on the coast. Mr. President, I can name you 16 different wharves between Golden Gate and Point Loma, just north of San Diego, built out into the sea precisely the same as the wharf is built at Santa Monica. They have not cost that amount of money, it is true, because there was no necessity for it, and while it would be presumptuous in me to criticize the great expenditure of money upon the Santa Monica Wharf, yet it cost twice what was necessary; that is, a wharf costing one-half as much would have answered every purpose.

But this great railroad company does not do things by halves. It has tunneled

the great Sierra Nevada. It has spanned great streams in Arizona, where the cloudbursts come down and, like an avalanche, wash out miles and miles of road. Yet it rebuilds it, and builds it to stand like a light-house upon a rock. It does things thoroughly and in a masterly manner, because it has great resources, and so it has built this wharf as it builds other structures which it undertakes. But I submit it was not necessary to build it so strong or so long or so wide unless it wished to do so in order to hold great coal bunkers, that the coal may be discharged into those bunkers, loaded on to cars, and transported by cars to the various depots in southern California, Arizona, and New Mexico. There is a wharf to-day at Hueneme, a place about 40 miles north of Santa Monica, which did not cost over \$75,000. It is built in a place not so well protected, because there is not the Catalina Island, and the Catalina Island is what protects San Pedro in a great degree. It breaks the southwest swells that the Senator from Maine (Mr. Frye) talks about.

The prevailing winds on the coast of California during the summer months are from the northwest. They are the great trade winds, and they blow for four and five months in the year. Trade winds sound to those who are not initiated perhaps like a gentle zephyr, and yet it may be said to those who are not accustomed to them that they pick up a good sized pebble and hurl it across the street. They prevail for four or five months in the year, and they are very strong when they blow. They commence in the morning and blow until late in the afternoon and evening. In the winter time the storms come from the southwest. The wind usually commences to blow very strong from the southeast. It hardly ever blows for more than a few hours from that point of the compass, when it veers around to the southwest, and there it blows with great strength and force. By reason of the location of Catalina Island, San Pedro is protected from those very heavy sea waves that roll in from the ocean. While Santa Monica in a degree is protected, yet it is not protected to that extent, or our friend Captain Taylor, who made the report, would not have been obliged to leave his anchorage and seek the sheltering protection of the lee of Catalina Island.

I find in looking at the chart which is before us that at Santa Monica—and anyone will notice it by closely observing the map—there are various lines running north and south, following the meanderings of the coast. They are called the 5-fathoms line, the 10-fathoms line, the 15-fathoms line, and the 20-fathoms line. Surveyors seldom go outside of that. I find by examining the 10-fathoms line, which is 60 feet deep, that at Santa Monica it is only one mile and a half from the shore. If this wharf is 1 mile long there would be only a half mile between the end of the wharf and the breakwater; and if other wharves are built out, as they must necessarily be—this is to be not only a harbor of refuge, but also a great commercial harbor—there must be hundreds of wharves to accommodate the shipping. Where, then, is the anchorage for the great ships that will come there from the Orient, from the islands of the Pacific, through the Nicaragua Canal, which we all hope and expect to live to see constructed? Where will there be anchorage for those vessels if there is only a half mile between the end of the wharf and the breakwater? It is true that the engineer reports say there is an area of so many acres. That will be between the wharves, and every nautical man knows that it is impossible for vessels to navigate successfully among them even in charge of a towboat.

The wharf at Santa Monica, as I have said, has been a good business investment. I believe the saving alone to the Southern Pacific upon its lighterage of coal and lumber and other supplies will amount to not less than \$15,000, and perhaps \$20,000 per month, and by reason of their facilities for doing other business, for handling merchandise coming in over the wharves from other countries, as well as our own Coast States, they can handle it much more cheaply than anybody else can, and this will correspondingly add to their revenue. Therefore, the building of this wharf is a splendid business investment, and I do not believe that the projectors of the wharf when they built it had any expectation of asking the Government to build a breakwater. Fifteen miles south of San Pedro there is a wharf called Newport Wharf. It runs out into the ocean about 800 or 1,000 feet. During the past eight months 35,000,000 feet of lumber alone have passed over that wharf, besides thousands and thousands of tons of grain. The same is true at San Buenaventura, Hueneme, and the other wharves on the coast. Every one of the owners of those wharves would like to have a breakwater. It would be a great benefit to the respective ports; it would be a great benefit to the wharf, and yet it would not make a commercial port or a harbor of refuge of any one of those ports more than they are at the present time. It is a law which never yet has been successfully opposed that a breakwater can not be successfully constructed that runs parallel with a rectilinear shore.

It is contrary to the very nature of things that it can be. At Santa Monica, as well as in other open roadsteads, every twenty seconds there is a wave rolling in like a great battering ram, striking against the beach or sea wall, against the breakwater, against the wharf, or whatever may obstruct it. The most successful wharves that have been constructed on the coast are the wharves that present the least surface

of resistance for the waves to strike against. Take a vessel and place it diagonally across the end of the wharf at Santa Monica or any other wharf extending into the sea, and I would almost wager my hope of future existence that if a southwest gale prevailed for twenty-four hours the vessel would sink at the end of the wharf or the wharf would be a story of the past. It can not be otherwise.

There is not an artificial breakwater constructed anywhere in the world of which we have knowledge that is built parallel to the shore. At Cherbourg, the great naval port on the coast of France, there are three land sides, and the great dique or breakwater is 2½ miles from the inner shore. It was commenced, I think, in the reign of Louis XVI. It was years and years—a hundred years I think—before it was completed. It cost an enormous sum of money—more than \$30,000,000—and for the first years of its construction it did not resist the action of the waves. Yet it is exposed only to the short, choppy seas of the British Channel. Contrast that with the undulating, never-ceasing waves of the Atlantic or the Pacific, rolling in every twenty seconds, as I said before, thundering against this broadside. I believe the Government engineers are right when they say it is almost an engineering impossibility to construct such a breakwater.

While passing upon engineers, I wish to say one word. Yesterday eulogies were delivered upon the magnificent work accomplished by Mr. Eads in the Mississippi River, and deserved credit was given to him. None hold him or his memory in higher admiration and esteem than do I. I knew him well, and when governor of California I took the responsibility of inviting him to come to that State and there investigate the great question that was agitating the public mind—the filling up of our rivers with the debris flowing from the mines. He came there. He made a personal examination, and his report has been productive of much good and benefit to our people. We are carrying out, on the lines he proposed, some of the improvements to our rivers with the most satisfactory results. Yesterday in the discussion the Senator from Missouri [Mr. Vest] or the Senator from Oregon [Mr. Mitchell] said that all the credit was due to him, and that the Government engineers were mistaken. I do not claim that the United States engineers are infallible. They undoubtedly make mistakes at times.

Mr. MITCHELL, of Oregon. Will the Senator from California yield to me for a moment?

Mr. PERKINS. Certainly.

Mr. MITCHELL, of Oregon. I was surprised in looking over the Record this morning to find that in the little colloquy I had with the Senator from Louisiana [Mr. Caffery] yesterday I inadvertently made a statement which was entirely too broad and is calculated to do an injustice to the Engineer Corps.

In attracting the attention of the Senator from Louisiana to the Eads proposition in 1873, when that subject was before the Senate committee, I said:

"At that time a controversy was going on in one of the committees of this body, of which I happened to be a member. Mr. Eads came before the committee with a project for improving the mouth of the Mississippi River. I had but little faith in it. I was a member of the committee, as I stated. The army engineers were unanimous in opposition to his scheme, from the Chief of Engineers down."

The latter statement was inadvertently and unintentionally made by me. What I intended to say, and what I really supposed I had said until I read the Record this morning, was that the then Chief of Engineers, General Humphreys, and those associated with him in the office here—in other words, that portion of the Engineer Corps whom we consulted then as we do now, General Craighill and his associates—were unanimously opposed to the Eads proposition. That is what I intended to say, but my statement was entirely too broad when I said that the whole Engineer Corps, from the Chief of Engineers down, were opposed to it. That statement was an injustice to the Engineer Corps, and I intended, as soon as the Senator from California took his seat, to make the correction. But inasmuch as the Senator was referring to the matter at this time, I thought the proper time to do so was now.

Mr. PERKINS. I could not expect less from my distinguished friend, the Senator from Oregon (Mr. Mitchell), than that which he has so frankly stated and which is a simple act of justice to our Government engineers. I was about to say that I am sure he was laboring under some erroneous impression or that he had received wrong information, as the facts he has stated had been imparted to me personally by Mr. Eads.

There is one other thought. I do not like to trespass so long upon the patience of the Senate, as the question has been so thoroughly discussed. My distinguished colleague (Mr. White) presented it in all its phases, and I have endeavored not to enter upon any of the particular lines of thought which he followed. There are some suggestions, however, which I have gathered in the practical school of experience which it seemed to me pertinent to offer at this time, and that is my excuse for intruding so long upon the patience of the Senate.

There is one point against constructing a wharf in an open roadstead or arm of

the sea which has not been alluded to, and that is the undertow. It may not be known to all, especially to those who have not given it thought, that any shore presenting a line to the ocean has what is known as an undertow; that is, the waves come rolling in like an avalanche, combing up over each other on the beach, taking a rotary motion. The result is that when the waves recede they run back with a strong undercurrent. That is what nautical men call the undertow. Any vessel lying at one of these open wharves feels the effect of this undertow. It is stronger than the waves which are pressing her in toward the beach. The careful mariner moors his vessel so that in surging backward and forward the line that holds and counteracts the effect of the undertow is as strong as the one that resists the desire of the waves to press the vessel on to the shore. The result is that the vessel is in a swing, as it were, backward and forward, forward and backward, with the never-ceasing motion of the ocean.

I do not believe, and I do not think any engineering man does, that any break-water exposed to the open sea can be constructed which will counteract the action of the undertow. It is fatal in a degree to the rapidity and the safety of handling freight. We lose large quantities of freight overboard and by being broken by falling from the slings upon the wharf, caused by the constant surging to and fro of the vessel. At Port Harford there is a rock perhaps 3,000 feet out from the north point of the bay, and the Government has made appropriations for the building of a break-water from the shore to this rock. The harbor is landlocked almost, and yet the undertow is present, especially when there has been a severe storm at sea. It must continue there. It is against the law of nature to have it otherwise in bay, inlet, or other place where the actions of the waves can affect the water. Therefore it is impossible to have in any open roadstead a successfully protected harbor where the vessels may be taken on the beach, or launched from the beach, and boats pulled up for repairs or safety.

The amendment proposed by my distinguished colleague (Mr. White) provides that a new Commission shall be appointed, whose duty it shall be to reexamine these two localities—Santa Monica and San Pedro. In doing this he has stated that which the people expected. He has voiced the sentiments of the people of California, the people of his own city, the people of the great West, that commerce demands and requires a great port of entry and a port of export in California. We want this money expended where it will do the most good. We want the Government to help us build this harbor, but we do not want them to build it at a place where commerce will derive no benefit. As there has been a great difference between private engineers and Government engineers as to the best locality, my colleague says, "Let us have a new Commission." First, we will select one engineer from the Navy, with rank not lower than that of commander. He holds his position for life. He is educated by the Government, and step by step, from midshipman to ensign, from ensign to lieutenant, from lieutenant to commander, and from commander to captain, he has won his epaulets by service. He holds his appointment during life or good behavior, not subject to the caprice of any political party. Who can object to such a Commissioner?

He selects another one who is connected with the Coast and Geodetic Survey. Who is as capable to judge as the one who made the charts, who made the soundings, who knows the hydrography of the sea as well as the topography and the triangulations of the land? He says, "Let us select one from that department." Then, wisely, in my opinion, he has said that after the money has been appropriated by the Government it must be expended by the United States Corps of Engineers. The Corps is composed of men who, as I said before, are selected because of their skill. They, too, have advanced by reason of their special fitness to discharge the duties of their important offices. They have never proven recreant to duty, nor have they failed in any charge delegated to them. It seems to me eminently proper that one member should be selected from the Corps of Engineers, because they are to construct the work, and they should pass upon the practicability of doing so—whether there is good material at hand, whether it is an engineering possibility. Yet my friend, the Senator from Maine (Mr. Frye), says, and I hardly think he means it, that a subordinate would not dare to differ with his chief, that a subordinate would not dare to set up an opinion of his own. My friend, the Senator from Maine, does great injustice to true manhood when he says that. It is the primary lesson, it is one of the elementary studies in that academy, that the young cadet shall be independent, that he shall speak for himself and reason for himself. It is the benefit of the judgment of such men, and not their superiors' judgment, that the amendment proposes to give to the Commission. I say it is unjust, it is unfair, to make the assertion.

But I feel so deeply interested, I am so anxious that an appropriation shall be made for a great commercial port in the proper place, that I wish to ask my colleague to consent to this amendment and thereby quiet the objection of the Senator from Missouri and the Senator from Maine. I want him to make this proposition to those who so strongly advocate the location of the breakwater at Santa Monica. I

want him to say to them, "Although it is not right, it is not just to the engineers, yet I will sacrifice my feeling in the matter, and, if you will consent to this amendment, I will agree that the President of the United States shall, instead of one member from the Engineer Corps of the Army, appoint one from civil life—a practical engineer." I believe, upon reflection, he will consent to do this, and if he does the amendment should be unanimously adopted.

Mr. STEWART. Will the Senator allow me?

Mr. PERKINS. Certainly.

Mr. STEWART. There was a question suggested yesterday with regard to the rivalry between different railroads to obtain access to the Bay of Santa Monica. What is the fact in regard to that, and what is the law in regard to connection with the harbor?

Mr. PERKINS. I do not think that there is so much in that proposition as has been made to appear. I do not think that any railroad company can monopolize any one port. While, if they own the land, they have a great advantage as to warehouses and other terminal facilities, yet under the laws of our State, as I understand them, anyone can make application to the board of supervisors for a franchise to build a wharf anywhere on the coast within one or two thousand feet of another wharf. It is only necessary for them to show that the demands of commerce or of business require it, and the board of supervisors can then regulate the rates of toll over the wharf.

Mr. STEWART. There is no arbitrary rule, then, but it may be done wherever it may be required by commerce. Have they that right?

Mr. PERKINS. I so understand.

Mr. STEWART. Is the Senator advised as to who owns the land at Santa Monica?

Mr. PERKINS. I am not; but it matters not who owns it. The right of way can be condemned there and other wharves can be constructed if the proper showing be made to the board of supervisors.

Mr. STEWART. There has been some question made with regard to the position of the outer harbor at San Pedro. It has been suggested in argument that it is open to the southeast wind, and that that was an insuperable objection to it.

Mr. PERKINS. I did not feel called upon to expatiate particularly upon the merits of San Pedro Harbor, because we have the reports of two Boards of Engineers before us, and they have been spread in full upon the records of the Senate, and have fully answered the queries in relation to that subject.

Referring to the southeast winds, I would say that they prevail, but are of very short duration. They blow pretty strong while they are blowing, but it is the experience of all nautical men that the winds blowing from the southeast soon chop around to the southwest, and the sea waves that roll in all come from the southwest. One of the advantages of San Pedro over Santa Monica is that the island of Santa Catalina, located some 15 miles away, about 18 miles long, rising up out of the ocean nearly 3,000 feet, acts as nature's great breakwater to the bay of San Pedro.

Mr. STEWART. As to winds coming from the south?

Mr. PERKINS. As to winds from the south and west.

Mr. STEWART. I am talking about southeast. The gale comes sometimes from the southwest; but if a heavy gale comes from the southeast what effect would it have on the San Pedro harbor? What effect would it have upon ships sailing into the bay?

Mr. PERKINS. It depends upon their ground tackling, their anchorage. I have known a great many ships to hold on there during a southeast gale.

Mr. STEWART. Would that depend entirely upon the ground tackling?

Mr. PERKINS. There is no question about that; it would be as at any other place.

Mr. STEWART. The Senator will recollect he explained to me one day the effect of the case made before the committee, and if I understood him aright he thought Santa Monica was decidedly the better place.

Mr. PERKINS. Not the best place, but that the best argument had been presented.

Mr. STEWART. And that all the weight of evidence was in favor of Santa Monica?

Mr. PERKINS. I did. I listened to the testimony before the Committee on Commerce of the Senate, and I am frank to say that it presented a very taking case, but, upon examination of the charts of the coast, especially of the 10 and 15 fathom curve line, and the soundings off Vincente and Point Firmin and Point Dume, I think the truth was painted by the advocates of Santa Monica in Titian colors.

Mr. STEWART. The Senator has described the harbor of Santa Monica as being exceedingly dangerous on account of the constant moving of the waves, and yet during the last three or four years vessels have loaded and unloaded at that port without difficulty. Is not that correct?

Mr. PERKINS. There is no question about that. I think I admitted in my remarks that ships, unless there were very heavy gales, could and did lie close to those wharves and discharge their cargoes, but, of course, not with the ease or facility that they could in still water. That applies to Santa Monica, and I also state that it applies with equal force to 16 other wharves on the coast which I could name. Our

captains, or those who have charge of vessels navigating the ocean in the coastwise business, become thoroughly familiar with these different localities. It would seem at times almost impossible to make a successful landing; and yet they have done so, and continue to do so. I reiterate that which I stated before, that Santa Monica is one of the best wharves on that coast or any other coast. It answers the purposes for which it was constructed. It was and is a good business investment; but the question we have under consideration is the appropriation by this Government of \$3,000,000 for the purpose of building a breakwater. Is it practicable to build this breakwater, and, if it is built, will it bring the result that each of us desires?

Mr. STEWART. Is the Senator in favor of building a breakwater at one or the other place, or in favor of abandoning them altogether?

Mr. PERKINS. With the report of the Board of Engineers before me—

Mr. STEWART. I am speaking now of the Senator's knowledge of the situation. He is a sailor and navigator, and I want the opinion of a sailor and a navigator in the Senate. I want to say that these engineers are selected on altogether different lines. As has been stated, they are selected on account of their military knowledge; they are builders of military forts; they do not navigate the sea, and I would rather trust the Senator from California as to any harbor on the coast where he has navigated and where he lives than any corps of engineers. Of course, he would know more about it, because it is his specialty; it is in his line.

It is not the business of the engineers to find harbors. They construct harbors after they are found. I remember an instance at Duluth. I was interested there. The engineers reported that the only way to build a harbor there was at the mouth of the St. Louis River, about 5 or 6 miles south of Duluth. The people were very anxious that there should be a harbor on the northwest corner, but the engineers were all against it. They finally dug across the points which run out there several miles and connected with the bay inside. They ran across this point up near Duluth, when they were enjoined. Finally they got inside and made a good harbor, after the engineers had all given it up. They have built up the main harbor now, and the objections the engineers made to it have not materialized. Engineers may be mistaken, the same as anybody else; and locating harbors, as I have said, is outside of their specialty. But the point I make is that the Senator from California has some experience, and I will ask him one or two more questions.

Mr. PERKINS. Let me first answer the questions the Senator has already put.

Mr. STEWART. Very well.

Mr. PERKINS. When the Senator comes to California this summer I shall be pleased to take him yachting, and I shall try to find some quiet little cove, where we can discuss this question fully, and, combining the placid waters of the Pacific with other artificial ingredients which we will secure, we shall make the trip a pleasant one for him.

We are acting here, however, Mr. President, in the capacity of representatives of the people, and voting to appropriate a certain sum of money for certain purposes. It may not be improper for me to state that I accompanied a delegation to the Committee on Commerce of the House of Representatives early in the session—a delegation that came from San Jose, Cal. They were asking for \$25,000 for the purpose of straightening an arm of San Francisco Bay, an estuary that runs up to the town of Alviso, which is the depot for vessels from the great Santa Clara Valley. The gentlemen composing that committee listened to the remarks of the delegation patiently for a time, and finally interrupted with the question, "Have the Government engineers surveyed that place?" "Yes; some years since." "Have they made an estimate of its cost?" "No." "Do they recommend the appropriation?" "Well, no; but yet they favor it." "It is useless, gentlemen, for us to listen to you. It is a rule of this committee and of Congress to make no appropriations for rivers and harbors or like improvements until the Corps of United States Engineers have surveyed them, have estimated the cost, and recommended the practicability of the same."

The delegation returned to San Jose; and ever since the Committee on Commerce of the Senate has recommended the expenditure of \$3,000,000 for the improvement of Santa Monica against the recommendation of the United States engineers I have been wondering what I should say to that delegation when I returned to California and was confronted by them and they said, "You, our representative, could not get us even a hearing because we had not the recommendation of the Government engineers, and yet in the Senate you appropriated \$3,000,000 for an improvement which the Government engineers have not recommended." I have been wondering what I shall say to them in reply. The only answer I can find is that perhaps the Senator from Maine or the Senator from Nevada will explain the action taken.

Mr. STEWART. I am trying to find out what the Senator thinks about this question, for I regard his opinion as much more valuable than that of a man who is not an expert in navigation. The Senator is a sailor. He has already said that Santa Monica was an excellent place—the best place on the coast. He has already told us

that ships have been in the habit of loading and unloading there without any difficulty for the last three or four years. I ask the Senator, could they do that at San Pedro?

Mr. PERKINS. I think so, after constructing a proper wharf, not the same as my friend from Maine, who is very ingenious, but wanted to build with its side to this breakwater. I admired the ingenuity with which he presented the case yesterday. Here is the point: He proposed building a wharf heading west instead of southwest at San Pedro, and then a southwest wind would strike against it broadside. I would have said to him, "Senator, I would build my wharf head to the sea, and then it would stand." Of course it will not stand otherwise, or on the line you would construct it upon.

Mr. STEWART. They can build a wharf just as the case stands now to answer equally for the purpose at Santa Monica?

Mr. PERKINS. I think so.

Mr. STEWART. Then they were very foolish to leave off building a wharf there?

Mr. PERKINS. No; because the other place is some twelve hours nearer to San Francisco, and has some other advantages.

Mr. STEWART. What other advantages has it?

Mr. PERKINS. It has deeper water, and they are saved from building a long line of railroad out to San Pedro Point to the wharf. The Senator is thoroughly familiar with it. The wharf could be built outside of Deadmans Island and run out southwest to the sea without any trouble.

Mr. STEWART. Do I understand that the Senator is willing to have an appropriation made at one place or the other?

Mr. PERKINS. I want to reiterate again and again that the necessities of southern California demand a deep-sea harbor. We want to make no mistake, and I am willing to vote for this amendment, and I hope my friend, if he wants the best place selected, will vote for the amendment proposed by my distinguished colleague from California, and make this appropriation definitely.

PROTECTED HARBOR AT PORT LOS ANGELES, IN SANTA MONICA BAY, CALIFORNIA.

[Abstract of remarks before Committee on Rivers and Harbors, House of Representatives, by E. L. Corthell, C. E., and William Hood, chief engineer Southern Pacific Company, February 28, 1896.]

The importance and need of this improvement was shown by the following statements:

(1) There is at present no adequate or protected harbor between San Francisco and San Diego, over 500 miles.

(2) Southern California, of which the city of Los Angeles is the center of population and trade, has increased in population and similarly in all other directions about 350 per cent in the last fifteen years, and Los Angeles is only about 12 miles from Port Los Angeles, where it is proposed to build the breakwater and make a protected harbor.

(3) Los Angeles is situated very favorably as to railroads extending eastward and in respect to a large port of entry of foreign imports and exports as well as by way of Cape Horn, Straits of Magellan, the proposed canals or railways across the isthmus, and directly by ocean navigation to China, Japan, and Australia. The grade of the principal railroad eastward, by which a large part of the business from San Francisco goes to New Orleans, is only 52 feet per mile, while the grades going north to the port of San Francisco are 116 feet to the mile and a 4,000-foot summit has to be overcome, and east of San Francisco the grades are equally as heavy and a 7,000-foot summit has to be overcome.

Generally speaking, the ocean along the coast of southern California, particularly in the region of Los Angeles, is not as tempestuous and the seas are not as heavy as north of that point, the principal reason being the outlying groups of islands in the ocean.

The following are the reasons why Port Los Angeles, in respect to this sea approach, is more favorable than other points south, particularly San Pedro, which has been proposed as the location for the protected harbor:

(1) Port Los Angeles is in the deepest part of Santa Monica Bay; that is, the point that is farthest inland from the general shore line of the coast. (See Exhibit No. 34, small chart of coast; No. 21, United States Coast Survey chart of California coast; also No. 35, United States Coast Survey map of this part of the coast.) All showing that Port Los Angeles is at least 15 miles inland from a line drawn between the outlying headlands, Point Dume on the north and Point Vincente on the south; it also shows that the present inlet to Wilmington Harbor at San Pedro is only 1 mile inland from a line drawn from the headland at San Pedro to any projecting point south of it.

(2) The breakwater at San Pedro, on whatever plan designed, whether a continuous breakwater or isolated, as proposed by two different United States Boards, must

necessarily be in the open ocean—that is, beyond the headland—exposed to the full force of the ocean waves.

(3) The gentle slope of the ocean bottom in Santa Monica Bay has a marked modifying influence upon the storm waves. The difference between the two locations in this respect is shown plainly by Exhibit No. 39, where the sea slopes at Santa Monica and San Pedro are drawn on the same sheet, one over the other.

(4) The country back of Santa Monica is much higher comparatively than at points south. This modifies the effect of the winds coming from the north and northwest, but particularly those coming from the ocean, as very clearly stated by Commander Taylor on pages 109 and 110, House Ex. Doc. No. 41, Fifty-second Congress, second session, being Exhibit No. 2. He states that the Bay of Santa Monica is unique on that coast, not only on account of the sea slope above mentioned, but on account of its position in reference to the "neighboring range of mountains against or toward which blow the only winds of violence. The force of the wind blowing against a great barrier is deadened for some distance to windward of such barrier, and this probably accounts for the well-known fact that the winds at Santa Monica do not blow with violence."

(5) At San Pedro, as the charts will show, the southeast winter winds would blow into the harbor without any obstacle, even after the breakwater is built. At Santa Monica, the port being 15 miles inland and considerably protected by the high lands at Point Firmin, southeast of the bay, the winds are modified considerably in violence.

(6) The charts submitted also show that from the location of the breakwater at Port Los Angeles in the direction of the ocean swell the line of the coast to Point Dume, 15 miles, is nearly parallel to it, which has a tendency to retard the wave motion as the waves gradually approach the proposed breakwater. It will also be seen that, continuing this direction, the group of Santa Barbara Islands also modifies the waves before they even reach the vicinity of Point Dume. There is also a group of islands lying southwest in such positions as to also modify the action of the waves coming from that direction; in other words, the deeply indented point of Santa Monica Bay is practically surrounded by highlands, inlands, and islands seaward, all of which serve to modify the effect of waves. This is clearly shown by Exhibit No. 16, a photograph of a relief map of the coast of California, including the mountains and the bed of the Pacific Ocean.

(7) The holding ground for vessels is excellent in Santa Monica Bay, the bottom being composed of clay, sand, and gravel, which have been proven to exist over the entire area of the deep water by borings taken for the purpose of building the great ocean pier and from the pile-driving record during the construction of it. At San Pedro, as will be seen from Exhibit B, above referred to, there are large rocky areas, as indicated by the kelp or seaweed shown on the chart.

In reference to the land approach, the harbor of Port Los Angeles has the advantage in every respect.

(1) From Exhibit No. 23, Southern Pacific right of way at San Pedro, and from No. 24, being the railroad right-of-way map of Santa Monica, it will be seen that under the bluff at Santa Monica back of the proposed harbor there is, outside of the Southern Pacific right of way, extending to the high-water line, a strip of land from 100 to 200 feet in width, where a large number of railroad tracks can be laid and which land can be procured from the owners of the tract, who sold the 50-foot strip of land to the Southern Pacific Company for its right of way and were not willing to sell any more, as they preferred to retain it for the benefit of other railroads which might wish to have the benefit of this harbor.

(2) At San Pedro, between the mouth of the river at Wilmington, the entrance to the present harbor, and Point Firmin, near the proposed location of the breakwater, covering the entire available harbor room, there is a bluff 60 or 70 feet high of clay and shaly rock, the foot of which is washed by the waves. There is a table-land back of this bluff rising as it recedes from the edge of the bluff. The Southern Pacific Company owns the entire frontage on the top of this bluff to San Pedro Point, the land or right of way being of considerable width and occupied by railroad tracks. Any railroad company desiring to build piers into the protected harbor would necessarily have to cross the land and tracks of this company; but this is not the greatest obstacle in the way, as, of course, rights to cross could be obtained, no doubt. To build steeply descending tracks from this table-land to wharves in the proposed outer harbor is so expensive and would be so difficult of operation afterwards, together with the difficulties and expenses of building wharves in the rocky formation which forms the ocean bed for some distance from the foot of the bluff into the ocean, was the reason why the Southern Pacific Company considered it an improper proceeding financially and stopped work on their proposed improvements, not only upon the land approach, but upon a wharf in the proposed protected harbor; all of which physical conditions are shown on Exhibit No. 23, above referred to.

The Southern Pacific owns most of the wharves and tracks at Wilmington, on the west side of the harbor. The Los Angeles Terminal Railway has an approach to this harbor on the east, or what may be called the wrong side of the harbor. In order for

it to reach the protected harbor it would be necessary for it to extend its tracks a considerable distance along Rattlesnake Island, and then to cross the present Government breakwater and the channel by a drawbridge, which would, of course, be a very great obstacle, and probably be prohibited as a nuisance to the navigation of the inner harbor.

All of these conditions make the proposed protected harbor practically closed against railroad approaches and make it useless for the purpose for which it is intended. At Santa Monica there are also two railroads—the Southern Pacific and the Southern California. The latter can conveniently, if it wishes, reach the strip of land above described lying opposite the protected harbor. If it should be needed for the convenience of this railroad to connect with and to have a trackage over the approach tracks of the Southern Pacific, which are laid in the village of Santa Monica, the latter company has agreed, in the discussion of this subject, to give not only equal rights with itself to any railroad company, not only upon these tracks above mentioned, but upon the tracks under the bluff approaching the protected harbor, so that it may be stated definitely that it is the Port Los Angeles (protected) Harbor which is free to the approach of all railroads which desire to utilize it, and it is San Pedro Harbor which is not and never can be provided with free entrance or approach to any other railroad.

There are no improvements at present in the deep water of San Pedro Bay. All freight that arrives in deep-draft vessels has to be lightered into the shallow harbor at Wilmington. At Port Los Angeles the Southern Pacific Company built, about two and one-half years ago, a great ocean pier extending to a depth of over 37 feet of water at mean high tide or about 33 feet at low tide. This pier with its approaches has cost nearly \$1,000,000. It is equipped with a very complete mooring system for vessels, which are of course obliged at times to use this system until a breakwater is built. It is also provided with a number of railroad tracks and extensive coal bunkers, a passenger station, etc. It extends into the sea over 4,000 feet, and is 130 feet wide at the sea end and 12 feet in the clear above high water—high enough to allow the highest waves to go under it freely. A photograph and Exhibit No. 5, being the mooring system of this wharf above referred to, show the size of this pier. It was stated by Mr. Hood, in answer to question by the committee, that the Southern Pacific had expended in wharves, right of way, tracks, harbor facilities, and approaches to Wilmington Harbor and San Pedro Bay nearly \$3,000,000. Having become satisfied with their experience that a suitable deep-sea harbor could not be made there, they investigated carefully the coast north of that point, and satisfying themselves by these investigations that Santa Monica Bay was the only place for a deep-sea harbor, they immediately began the expensive improvements above referred to.

Experience at this ocean pier has proven that their judgment was well founded. The reasons why they have been able to handle a large commercial business to the entire satisfaction of shipmasters and safety of their vessels have been already stated in showing the nautical advantages of Santa Monica Bay.

The facility and safety of discharging and receiving cargoes at this pier are proven by abundant testimony on the part of shipmasters and others who have to do with this business; these affidavits from these shipmasters and others entirely familiar with the commercial business performed at this pier during the last two years are submitted with this abstract.

Another advantage that Port Los Angeles has is the fact that it is about 35 miles farther north than San Pedro. Nearly all of the coastwise business is to or from San Francisco—between that city and the city of Los Angeles—so that all the coastwise steamers necessarily touch at the Port Los Angeles pier on their way to San Pedro, so that passengers, particularly, are able to reach the city of Los Angeles by rail before they would, by remaining aboard, reach the harbor at San Pedro; and the same of freight. In reference to large sailing ships around Cape Horn, they are obliged by the winds to keep out from the coast until about opposite Cape Capistrano, which is considerably north of Port Los Angeles, and then to tack down the coast, passing of course Port Los Angeles on their way to San Pedro. In reference to steamers that would pass through the Panama or Nicaragua canals, on such a long voyage as it would be from Liverpool or New York, or other Atlantic ports in a route of several thousand miles, the additional distance between San Pedro and Port Los Angeles would be a very small matter.

The proposed plan for a breakwater at Port Los Angeles locates it practically parallel with the shore line and in a depth from 7 to 8 fathoms and over 8,000 feet long. This makes it possible to lay out back of it a very extensive system of wharves convenient for railroad approaches from under the bluff. A suggested plan for this pier is shown on several of the exhibits submitted, particularly on No. 39, being a large-scale map of the harbor; on No. 35, a Coast Survey map of the harbor, and on No. C, a United States engineer's chart of this harbor. These piers, as shown on these charts, would give a deep-water wharf line of over 3 miles, and would easily

accommodate at one time immediately alongside of the wharf over 61 deep-sea vessels.

The breakwater as planned for Port Los Angeles would not only be parallel to the shore line, but would also be parallel to the westwardly shore currents, which move along the entire coast from San Diego at least to San Francisco, which were proven to exist by various references to expert authorities. This current carries with it more or less sand in suspension. A dike at San Pedro connected with the shore would arrest and deposit behind it these moving sands and would tend to shoal the entire area behind the dike. This was illustrated by the shoaling that had already taken place by the present Government breakwater, or jetty, at the mouth of Wilmington Harbor.

If, on the other hand, a detached or isolated breakwater should be built at San Pedro, the direction of it would need to be such and the opening of it would have to be so located necessarily as to leave the area behind it unprotected from the ocean swell. The two Boards of Engineers which have made plans for a protected harbor have not been in accord in regard to the location or plan of the work. The Board of 1891 (see Exhibit No. 1, being Ex. Doc. No. 39, Fifty-second Congress, first session) planned and located a breakwater with an opening exposed to the ocean swells about 1,500 feet wide. The Board of 1892 (see Exhibit No. 2 above referred to) appreciated the want of protection the harbor would have with such an opening and designed a continuous breakwater from Point Firmin, which, on the other hand, would no doubt cause the shoaling above referred to and which evidently the first Board was endeavoring to avoid by building an isolated breakwater, so that it may be said that neither plan is a suitable one, nor can a plan be designed under the peculiar conditions existing at this place to make as good a harbor and secure a permanent depth in it as at Port Los Angeles.

Various estimates have been made by these Boards of Engineers and by Mr. Hood. The estimate of the Board of 1891 placed the cost of a breakwater at San Pedro at \$4,126,106, and in Santa Monica Bay at \$4,813,440. The Board of 1892 made no estimate for Santa Monica, but estimated the dike which they proposed at San Pedro at \$2,885,324, but it was built in shoaler water and with a much smaller cross section than that proposed by the Board of 1891 for either of the two places, so that its estimate could not properly be compared with that of the Board of 1891 for either place. The Board of 1891 did not discover the best location for a breakwater in Santa Monica Bay. It was located at a considerable distance from the present proposed location, and from the location as proposed there by the Board of 1892. The estimate of Mr. Hood for a breakwater at Port Los Angeles is \$2,848,000, which the Chief of Engineers considers adequate. The question in regard to these estimates has been discussed fully in a communication recently addressed to the chairman of the River and Harbor Committee.

The present extent, variety, and international character of the commerce at Port Los Angeles, which started only about two years ago, with the completion of the Southern Pacific Company's wharf, will be seen by an examination of Exhibit D—Commercial.

At San Pedro the business is largely receipts of lumber to lumber yards at Wilmington Harbor. The customs paid on foreign freight imported there in 1895 was about \$3,000, mostly coal and cement, while at Port Los Angeles it was about \$66,000, the total value of imports being nearly \$2,750,000.

In the clippings on first page of Exhibit D are shown the nationality and miscellaneous character of the cargoes received in November and December, 1895.

It must be remembered that Wilmington (San Pedro) is an old established port for small vessels and for large vessels which lighter their cargoes outside, and that it always requires considerable time for foreign vessel owners and shipmasters to find out the advantages of any new port and to arrange to sail for it. The letters of the shipmasters, who have during the last two years learned by experience of the commercial condition of Port Los Angeles, show that they are not only satisfied, but are enthusiastic in reference to the favorable conditions they find there—the freedom from heavy seas, the good holding ground, the terminal facilities, and all the superior nautical and commercial advantages.

Washington, D. C., March 4, 1896.

E. L. CORTHELL.

Memorandum of exhibits accompanying Abstract of Remarks February 28, 1896, before Committee on Rivers and Harbors, House of Representatives, by E. L. Corthell and William Hood.

The order of exhibits follows the order of the text.

No. 34. Small chart of coast.

No. 21. United States Coast Survey chart of California coast.

No. 35. United States Coast Survey chart of coast in vicinity of Santa Monica and San Pedro.

These three show the deep indentation of Santa Monica Bay.

No. 39. Comparative profile of ocean bottom at Santa Monica and San Pedro.

No. 2. Ex. Doc. No. 41, Fifty-second Congress, second session, report of Board of 1892, pages 109 and 110, opinion of Commander Taylor, U. S. N., in favor of nautical conditions at Santa Monica.

No. B. San Pedro Harbor, showing rocky area.

No. 23. Southern Pacific right of way at San Pedro.

No. 24. Southern Pacific right of way at Santa Monica.

No. 5. Wharf and mooring system, Port Los Angeles.

No. 394. Large scale map of Santa Monica Bay, showing Southern Pacific Pier and other suggested piers.

No. C. United States engineer's chart of Port Los Angeles, showing suggested piers.

No. 1. Ex. Doc. No. 39, Fifty-second Congress, first session, report of Board of 1891.

No. D. Commercial. Showing commerce at Santa Monica.

No. 16. Photograph of relief map of coast of California, showing protection of coast by outlying islands.

No. 37. Shipmasters' letters.

No. 18. Photograph of pier, Port Los Angeles.

No. 35 A. Detail Coast Survey chart of Santa Monica Bay, with suggested plan of other piers.

No. 4. United States Coast Survey chart of Santa Monica, 1893, a large blue print showing suggested plan and piers.

NOTE.—There are about twenty-five other exhibits on file at the office of the Chief of Engineers.

STATEMENT OF MR. WILLIAM HOOD, OF SAN FRANCISCO, CAL.

MR. CHAIRMAN AND GENTLEMEN: Mr. Corthell has taken up the question so thoroughly that I think it leaves me very little to say, except to give some special reasons for the opinion which I advocate that Santa Monica Bay is the proper place for a deep-sea harbor to serve the vicinity of Los Angeles, Cal. I may say that I am the engineer of the Southern Pacific Railway Company, which, as you all know, is a railroad company in the State of California owning 66 per cent of the railroads in the State. It became my duty some years since, on an order of the proper officers, to determine for the company, as they were very largely interested, where a deep-sea wharf should be built for their own use. At that time, which was about 1890 or 1891, the only position on the Southern coast outside of San Diego where ships could meet the railroad was Wilmington or San Pedro. The Southern Pacific was the only company which had any tracks at San Pedro, or at any other points, except a narrow-gauge road at Redondo. The Southern Pacific naturally acquired the land beyond their tracks to build a railroad out to the proposed San Pedro deep-sea harbor, provided it should be built. The road went so far as to begin the erection of a wharf, and the difficulties were great.

The CHAIRMAN. How much money did the railroad invest there at San Pedro?

MR. HOOD. That is a difficult question to answer; but I should say that the land and wharves must have cost \$3,000,000. We commenced to build a wharf at that time at the proposed San Pedro deep-sea harbor, but we found the bottom very rocky. About that time the Southern Pacific Company was approached by prominent wholesale merchants and the Pacific Coast Steamship Company, who represented to the Southern Pacific Company that it was very important that the growing business should have a quick service, and that the railroads should meet the coast freight farther north than San Pedro. It was represented to the company that we should go as far north as possible, and that if proper wharves were built at Santa Monica it would be a great benefit to the public and to the merchants of Los Angeles, as they could get their goods from San Francisco to their stores so much more promptly than they could from San Pedro.

On their recommendations we determined on the point now called Port Los Angeles as being the very best point for the construction of wharves that we could find. The consequence was we built, in 1892 and 1893, a wharf and made examinations as to the proper site for a breakwater at that point, which breakwater is very desirable, and in general made a thorough study of the subject, putting \$800,000 into wharf and railroad construction. We found that in heavy storms the winds would be from the southeast, and the waves were nearly at right angles to this direction. The wharves drawn on this chart illustrate what might be the utilization of the protected harbor by other companies.

MR. CATCHINGS. Does that breakwater indicate the one that the Government engineers recommended?

MR. HOOD. This indicates the breakwater proposed by the Southern Pacific Railway Company, and it is reported on by the Government engineers, in which they practically say that this is the true position if it is to be constructed in Santa Monica Bay.

MR. HERMANN. How great is the force of those southeast currents?

Mr. HOOD. There are no large southeast waves, but there are strong southeast storm winds. No breakwater will protect against these winds, but it is a protection against storm waves which come from the southwest. The currents come up the coast, and practically find no obstruction, as they are parallel to the breakwater. Your question as to winds and waves is important. In a southeast gale the sea is at first choppy. These heavy waves from the south and southwest come in, the reason being that the wind from the southeast direction in a gale is due to local topography. The real direction of the windstorm in the open ocean is the same direction as the waves—that is, from the southwest. The local wind is usually at right angles to the waves. All the reports show that, and you will find it printed in House Ex. Docs. Nos. 39 and 41. The cost of a breakwater built as shown on charts, about 8,400 feet long, near Port Los Angeles is estimated at \$2,848,000. That is our estimate. The cost of a breakwater at San Pedro estimated by the Government engineers (House Ex. Doc. No. 41) is about \$37,000 greater.

Mr. McCULLOCH. Have the Government engineers estimated for the one at Santa Monica?

Mr. HOOD. No, sir; they have said that my estimate is unquestionably right.

Mr. HERMANN. There were two estimates made for San Pedro?

Mr. HOOD. Yes, sir. The difference in cost between San Pedro and Santa Monica is hardly worth considering. The real point is which breakwater will do the most good. There are two kinds of business to be accommodated on the Pacific Coast—the coastwise freight and passenger business and the ocean ship trade. No corporation is going to put up a wharf for one kind of business. Santa Monica has an extraordinary advantage for controlling coastwise trade, because the principal business is north from and south to Los Angeles, whereas ships from distant points, like around Cape Horn or the proposed Nicaraguan Canal, can reach Santa Monica about as well as San Pedro. The chief coastwise business is between San Francisco and Los Angeles. There is very little business between San Diego and Los Angeles; therefore you will notice that time freight coming from San Francisco to Los Angeles will necessarily get to Santa Monica first. Freight and passengers will be in Los Angeles before the ship bringing them to Santa Monica could get to San Pedro.

Mr. CATCHINGS. Ships would touch at Santa Monica?

Mr. HOOD. Any ship which did not would not get the freight and passengers, because passengers are in haste to get to their destination.

Mr. BURTON. How about through traffic from the Isthmus or the Nicaraguan Canal, should it be built?

Mr. HOOD. Take sailing vessels from Cape Horn, and their habit is to come in a northwest course. They generally sight Point Concepcion. They then come down with the westerly winds when their destination is Santa Monica and San Pedro. If destined for San Pedro, they would sail by Santa Monica.

Mr. McCULLOCH. Anticipating the construction of the Nicaraguan Canal, and granting that both would be made available, where will the bulk of the trade coming into Los Angeles come from—the south or north?

Mr. HOOD. I should think there would be a large ocean trade by way of the Nicaraguan Canal; and, so far as freight is concerned, it would be very immaterial which one was a little farthest, because in a voyage of several thousand miles I do not think 25 or 30 miles more would cut any such figure as it does in coastwise traffic.

Mr. McCULLOCH. Then you think San Pedro ought not to be made as good as Santa Monica in any event?

Mr. HOOD. I do not think San Pedro could be made as good as Santa Monica. I do not think anyone would put money into San Pedro if he had a chance to put it into Santa Monica. There has been some misunderstanding on the subject. There is room for seven or eight more single-track railroads there at Santa Monica.

Mr. HERMANN. That answers the objection, I understand, that the narrow strip of land there is monopolized by one company, and that it would be difficult for any other line to get access to this proposed breakwater?

Mr. HOOD. Yes, sir. And further than that, we would like to have secured a right of way of 100 feet, but we could not get it. The landowners only allowed us 50 feet, because they wanted to leave the remainder for some other roads.

The CHAIRMAN. How much space is there?

Mr. HOOD. Ninety to 100 feet, entirely outside of our right of way. In these figures I am conservative and keeping within bounds. Other roads can get in there. At San Pedro the situation is very different. I do not think the Southern Pacific Company would be an obstructionist, particularly, but if it wanted to be no railroad can approach a deep-water harbor at San Pedro without crossing our right of way and tracks, with one exception, and that is the Los Angeles Terminal Railroad, which terminates on Rattlesnake Island east of Wilmington Harbor, which road could get an approach to this deep-water harbor, if the Government would consent, by building a bridge with a draw across Wilmington Harbor, and thence could get in at the foot of a bluff 60 feet high, and thence could go into the protected harbor at a cost which I should not like to contemplate.

The CHAIRMAN. What would that cost be?

Mr. HOOD. It is difficult to say. It would be opposed by the Government engineers. The CHAIRMAN. Aside from that question, what would the probable cost be?

Mr. HOOD. I should think it might cost to get through to the proper point in proposed harbor five or six hundred thousand dollars, including bridge and railroad.

Mr. McCULLOCH. The Southern Pacific has the right of way to this harbor, and why is it that so many others are contending for this harbor?

Mr. HOOD. That has been one of the puzzles of my life. So far as I can judge, the advocacy for the San Pedro deep-water proposition is from the natural cause—that the expenditure of money in building a breakwater would raise the prices of real estate at least long enough for them to unload. It would also increase business by the expenditure of two or three million dollars, and would make property go up and cause temporary prosperity at San Pedro; and I have not the slightest doubt that if such a decision were reached by this committee the Southern Pacific would make money on sales of real estate to the amount of two or three million dollars.

Mr. McCULLOCH. What is the cause of so much difference between the estimates of the engineers who have investigated this project?

Mr. HOOD. That is difficult to answer for various reasons. I am inclined to think because San Pedro was the only place where ships came in, and it is from a kind of old-time habit.

The CHAIRMAN. Tell us how much money the Southern Pacific Company has expended at Santa Monica.

Mr. HOOD. In getting from Santa Monica to the wharf, including the wharf and coal bunkers, buildings, etc., I should say about \$800,000, aside from the original railroad, which ran simply to Santa Monica.

Mr. BURTON. You have spent more at San Pedro?

Mr. HOOD. Yes; we spent \$3,000,000 there for tracks and wharves and real estate.

Mr. BURTON. It has been a matter of deliberate choice as to which was better for your purpose?

Mr. HOOD. It was the deliberate choice of the Southern Pacific to go to Santa Monica, and it is a fact that it was a necessary choice, in order to have the benefit of that deep-water coastwise business.

Mr. HERMANN. In the event the improvement should be made at Santa Monica, would it lead to the abandonment of the works at San Pedro?

Mr. HOOD. We would abandon, possibly, certain tracks built there in order to reach the proposed harbor, but if we had use for them we would allow them to remain. As long as any business goes to the Wilmington harbor we would unquestionably continue to haul it.

Mr. HERMANN. It is argued that inasmuch as the greater portion of the commerce now seeks San Pedro, Los Angeles, Pasadena, Riverside, etc., therefore there should be an outer harbor at San Pedro.

Mr. HOOD. The business which now seeks the port of Los Angeles has been in lumber schooners. Some few ships go there with coal and a very trifling amount of general merchandise. The reason lumber comes there is that certain firms have acquired lumber yards there.

Mr. CATCHINGS. Do you mean to say that this business goes to Santa Monica?

Mr. HOOD. Yes. Occasionally a ship goes to San Pedro now which may be called a deep-water ship; but it is the practice there either to entirely unload by lighters, which involves extra handling, or in some instances lightering until the ship can drag itself over the bar. This is expensive. The cost of lightering coal into that port and delivering it on the cars was 75 cents a ton, and that would almost buy the coal on the Atlantic Coast.

Mr. CATCHINGS. Why should not a vessel with freight destined for the interior discharge right at Santa Monica?

Mr. HOOD. Why should a vessel not come to Santa Monica? They mostly do. When our wharf at Santa Monica was built there was opposition to it.

Mr. McCULLOCH. When did the Southern Pacific Railroad build its piers there?

Mr. HOOD. They built piers in the fall of 1892 and 1893. We were building the wharf about sixteen months.

Mr. McCULLOCH. Do you have any trouble in maintaining them?

Mr. HOOD. Not the least; if a breakwater existed there, we would not have built any such expensive wharf. Any other company would not have to build such an expensive wharf. It was alleged that the wharf would be strewn along the beach the very first winter storm that came, but we never had the least damage. The highest waves we had were 14 feet. With a breakwater there a lighter construction could safely be built.

Mr. McCULLOCH. You stated that you built out to an open roadstead.

Mr. HOOD. We did; and our success has been greater than we had any idea of. There is a question I would like to speak of: If a breakwater is built at Santa Monica, it would be necessary for some person to take the contract to build it. It could be built of rock brought by water or rail transportation. If it is brought by rail transportation, I am authorized to guarantee a rate of half a cent per ton per mile.

Mr. HERMANN. What influence would that have in the reduction of the figures you have given us as to the cost of construction?

Mr. HOOD. I could not tell you. The figures we made are based on my own experience in handling rock for other work in that region.

Mr. HERMANN. Did you also take into consideration the cost of making biennial appropriations, and that that necessarily would require a long time before the money would be appropriated?

Mr. HOOD. I took into consideration that the work could be completed in three years.

Mr. HERMANN. Did you make your estimates on that assumption?

Mr. HOOD. Yes, sir; that it would be completed in three years.

Mr. CATCHINGS. What was the estimate of the Board of Engineers as to cost?

Mr. HOOD. It was \$38,000 in excess of mine.

Mr. BURTON. You are now speaking of Santa Monica?

Mr. HOOD. That is for San Pedro.

Mr. CATCHINGS. Did not the Board of Engineers make an estimate of the cost at Santa Monica?

Mr. HOOD. Yes, sir; their estimate was about \$4,000,000, with a different cross section.

Mr. HERMANN. Do you think a greater amount of commerce now seeks Santa Monica than San Pedro?

Mr. HOOD. A greater amount, outside of lumber, seeks Santa Monica.

Mr. McCULLOCH. You spoke of Santa Monica Bay being dangerous in a strong wind. Has any damage or wrecks ever occurred there?

Mr. HOOD. No. Santa Monica is protected from the northwest by a range of mountains. It is perfectly safe without special appliances, except whenever there is a southeast gale. We have so far had no accidents, and I consider that a break-water would make it absolutely safe. The prevailing impression is erroneous, and that impression was manufactured by certain interests in making misstatements.

Mr. CATCHINGS. Would it answer as a harbor of refuge?

Mr. HOOD. Entirely. Vessels can run into that place from every direction, whereas at San Pedro there is only one side open.

Mr. McCULLOCH. Is not San Pedro regarded as the safest?

Mr. HOOD. The inner harbor there is simply a creek.

Mr. McCULLOCH. How far out does the outer harbor lie?

Mr. HOOD. It lies in front of Wilmington, or San Pedro Harbor.

Mr. McCULLOCH. Is not that better protected from northwest winds?

Mr. HOOD. I should think it was nearly as much so as Santa Monica.

Mr. McCULLOCH. What effect would the island opposite San Pedro have?

Mr. HOOD. The heaviest swells are from the west. Those islands are of no practical benefit. At Santa Monica the reduced height of waves is caused by the existing profile of the ocean's bottom.

The CHAIRMAN. Do you know anything about the proposition made by Mr. Huntington for the Southern Pacific Railway Company proposing to give a certain amount of money, providing the Government made a certain appropriation?

Mr. HOOD. I know that he made some proposition of that character.

Mr. STEPHENSON. He made the proposition that if the Government would give \$400,000 he would give the same amount.

Mr. CATCHINGS. My recollection is that Mr. Huntington's proposition was that he would give \$100,000, and he was anxious to do that, provided the Government appropriated \$100,000 alongside of that.

Mr. CORTHELL. I heard the statement of Mr. Huntington before the Senate committee, and he said that if the work was begun he would give \$100,000.

LOS ANGELES, CAL., December 28, 1896.

DEAR SIR: Have made a careful comparison of the names signed to the petition presented by Mr. W. C. Patterson to the Board of Harbor Commissioners on Saturday, December 26, 1896, with that which was signed on September 12, 1892. The former petition says: "As proof of the sincerity of our position in this matter, we desire to state that we who sign this petition have not and will not sign any petition addressed to the Board in favor of any other locality than San Pedro." The latter petition says: "We, the undersigned wholesale merchants doing business in Los Angeles, realizing the need of a safe and commodious harbor where deep-sea vessels and cars can be brought together, thus reducing the cost of handling freight to a minimum, beg of you to recognize the importance of having such located at the point nearest Los Angeles, so that time as well as cost can be reduced. Viewing the situation from a commercial standpoint, we are of opinion that Santa Monica offers to the merchants the advantages sought for, and we respectfully submit this as our opinion."

In the petition which was presented on Saturday I find the signatures classified as follows:

Wholesale merchants.....	18
Retail merchants.....	78
Banks.....	11
Real-estate agents.....	19
Clerks.....	54
Professional men.....	8
Capitalists.....	8
Farmers.....	5
Miscellaneous.....	15
Storage and commission.....	6
Lumber firms.....	12
Contractor and builder.....	1
Country signatures.....	15

I find, for instance, in the list of merchants under the heading of "Wholesale merchants," of the 18 which signed the petition of December 26, 1896, 10 of them appear on the petition of September 12, 1892.

Of the 78 retail merchants on the petition of December 26, 1896, I find 15 which had signed the petition of 1892.

Of the wholesale merchants which signed the petition of December 26, 1896, I find only the name of one firm who have to my knowledge imported any goods direct from a foreign country on vessels landing at a southern California port.

Of the wholesale merchants doing business in this city who do import direct, there are 10 whose names do not appear on Saturday's petition.

In fact, the names of the firms doing the largest business in the city of Los Angeles do not appear in Saturday's petition at all.

Of the 78 retail merchants doing business in Los Angeles, and whose names appear on Saturday's petition (15 of which appear on the petition of 1892), most of them receive some freight by steamer originating at points on the Pacific Coast, and which freight is handled by the coastwise vessels.

Again some of the largest retail stores in this city have not put their signature on Saturday's petition.

In fact, 125 of the 248 names which appear on the petition presented by Mr. Patterson on Saturday are not shippers at all.

Yours, respectfully,

P. H. SPRINGER,
Freight Solicitor, Southern Pacific Company.

WILLIAM HOOD, Esq.,
Chief Engineer, Southern Pacific Company.

Weather report, San Pedro.

WEEK ENDING JUNE 13, 1896.

Date.	Direction of wind.		Fog.	
	A. M.	P. M.	Time of setting in.	Time of clearing.
June 7.....	East.....	Southwest.....	None.....	7 p. m.
June 8.....	Southeast.....	West.....	do.....	
June 9.....	East.....	Southwest.....	Fog 5 a. m.....	
June 10.....	South.....	South.....	None.....	
June 11.....	do.....	Southwest.....	do.....	
June 12.....	East.....	do.....	do.....	
June 13.....	do.....	Southeast.....	do.....	

WEEK ENDING JUNE 20, 1896.

June 14.....	Southeast.....	Southwest.....	4 a. m.....	8 a. m.
June 15.....	South.....	do.....	None.....	
June 16.....	Southwest.....	East.....	do.....	
June 17.....	do.....	Southwest.....	5 a. m.....	9 a. m.
June 18.....	Southeast.....	do.....	None.....	
June 19.....	Southwest.....	do.....	do.....	
June 20.....	South.....	do.....	do.....	

Weather report, San Pedro—Continued.

WEEK ENDING JUNE 27, 1896.

Date.	Direction of wind.		Fog.	
	A. M.	P. M.	Time of setting in.	Time of clearing.
June 21	Southeast	Southwest	None	
June 22	South	do	do	
June 23	Southeast	do	do	
June 24	South	do	do	
June 25	do	West	do	
June 26	Changeable	do	do	
June 27	South	do	do	

WEEK ENDING JULY 4, 1896.

June 28	South	Southwest	None	
June 29	East	do	do	
June 30	Southeast	West	do	
July 1	South	Changeable	do	
July 2	do	Southwest	do	
July 3	Southeast	West	do	
July 4	South	Southwest	do	

WEEK ENDING JULY 11, 1896.

July 5	South	West	4 a. m.	11.30 a. m.
July 6	East	do	None	
July 7	Southeast	do	do	
July 8	South	do	do	
July 9	do	do	do	
July 10	do	Northwest	do	
July 11	Southwest	Changeable	do	

WEEK ENDING JULY 18, 1896.

July 12	East	Southwest	None	
July 13	South	West	5 a. m.	10.30 a. m.
July 14	Southeast	Southwest	None	
July 15	South	West	do	
July 16	Southeast	do	do	
July 17	South	Southwest	do	
July 18	do	West	do	

WEEK ENDING JULY 25, 1896.

July 19	Southwest	West	None	
July 20	Southeast	Southwest	do	
July 21	East	Southeast	do	
July 22	South	West	do	
July 23	East	do	do	
July 24	Southeast	do	do	
July 25	Southwest	do	do	

WEEK ENDING AUGUST 1, 1896.

July 26	East	West	None	
July 27	South	do	do	
July 28	do	do	do	
July 29	Southeast	do	5 a. m.	9 a. m.
July 30	East	do	None	
July 31	do	Changeable	do	
August 1	Southeast	West	do	

WEEK ENDING AUGUST 8, 1896.

August 2	Southeast	Southwest	None	
August 3	do	West	do	
August 4	do	do	do	
August 5	East	Southwest	do	
August 6	Calm	do	do	
August 7	Southeast	do	do	
August 8	Calm	do	do	

Weather report, San Pedro—Continued.

WEEK ENDING AUGUST 15, 1896.

Date.	Direction of wind.		Fog.	
	A. M.	P. M.	Time of setting in.	Time of clearing.
August 9	Calm	South	1.30 a. m.	10 a. m.
August 10	West	do	None	
August 11	Calm	do	do	
August 12	East	do	do	
August 13	Calm	Southwest	2 a. m.	9 a. m.
August 14	do	West	None	
August 15	Southwest	do	do	

WEEK ENDING AUGUST 22, 1896.

August 16	East	Southwest	None	
August 17	Southeast	West	do	
August 18	East	do	do	
August 19	do	Southwest	do	
August 20	Southeast	West	do	
August 21	East	do	do	
August 22	do	Southwest	do	

WEEK ENDING AUGUST 29, 1896.

August 23	East	West	None	
August 24	do	Southwest	do	
August 25	do	West	do	
August 26	do	do	do	
August 27	do	do	do	
August 28	Southeast	do	do	
August 29	East	Southwest	do	

WEEK ENDING SEPTEMBER 5, 1896.

August 30	South	Southwest	None	
August 31	East	West	do	
September 1	South	do	3 a. m.	5 a. m.
September 2	East	Southwest	None	
September 3	Southwest	West	do	
September 4	East	do	do	
September 5	do	Southwest	do	

WEEK ENDING SEPTEMBER 12, 1896.

September 6	East	Southwest	None	
September 7	do	West	do	
September 8	do	Southwest	do	
September 9	Southeast	West	do	
September 10	South	do	do	
September 11	do	do	do	
September 12	East	do	do	

WEEK ENDING SEPTEMBER 19, 1896.

September 13	East	West	None	
September 14	South	Southwest	3 a. m.	10.30 a. m.
September 15	East	West	None	
September 16	South	Changeable	do	
September 17	East	West	2 a. m.	4.30 a. m.
September 18	do	do	None	
September 19	do	Southwest	do	

DEEP-WATER HARBOR.

253

Weather report, San Pedro—Continued.

WEEK ENDING SEPTEMBER 26, 1896.

Date.	Direction of wind.		Fog.	
	A. M.	P. M.	Time of setting in.	Time of clearing.
September 20	East	West	None	
September 21	do	do	do	
September 22	do	Southwest	do	
September 23	do	West	5.30 a. m.	7.30 a. m.
September 24	North	do	None	
September 25	East	do	3 a. m.	10 a. m.
September 26	Southeast	Southwest	None	

WEEK ENDING OCTOBER 3, 1896.

September 27	East	Southwest	None	
September 28	do	West	2 a. m.	6 a. m.
September 29	do	Southwest	None	
September 30	do	West	do	
October 1	do	Changeable	do	
October 2	do	Southwest	4 a. m.	10 a. m.
October 3	do	West	5 a. m.	10.30 a. m.

WEEK ENDING OCTOBER 10, 1896.

October 4	East	Southwest	1.30 a. m.	10 a. m.
October 5	do	West	1 a. m.	10.30 a. m.
October 6	South	do	2 a. m.	Do.
October 7	East	do	None	
October 8	South	do	do	
October 9	East	do	do	
October 10	South	Southwest	do	

WEEK ENDING OCTOBER 17, 1896.

October 11	South	West	None	
October 12	East	do	do	
October 13	do	do	do	
October 14	do	do	1 a. m.	
October 15	do	Southwest	None	
October 16	do	West	4 a. m.	9 a. m.
October 17	do	Southwest	None	

WEEK ENDING OCTOBER 24, 1896.

October 18	East	West	None	
October 19	do	do	do	
October 20	do	do	5 a. m.	9.30 a. m.
October 21	do	Southwest	None	
October 22	Southeast	West	Rain, 4 a. m.	9 a. m.
October 23	East	do	None	
October 24	do	do	do	

WEEK ENDING OCTOBER 31, 1896.

October 25	East	Southwest	None	
October 26	South	South	do	
October 27	East	West	do	
October 28	do	do	do	
October 29	South	do	do	
October 30	East	do	do	
October 31	do	Southwest	do	

DEEP-WATER HARBOR.

Weather report, San Pedro—Continued.

WEEK ENDING NOVEMBER 7, 1896.

Date.	Direction of wind.		Fog.	
	A. M.	P. M.	Time of setting in.	Time of clearing.
November 1	East	East	None	
November 2	do	Southwest	do	
November 3	do	West	2 a. m.	9 a. m.
November 4	Northwest	South	do	11 a. m.
November 5	Southeast	Southwest	None	
November 6	East	East	11 p. m.	8 a. m.
November 7	do	Southeast	None	

WEEK ENDING NOVEMBER 14, 1896.

November 8	Southeast	South	None	
November 9	East	Southwest	do	
November 10	do	South	do	
November 11	North	Northwest	do	
November 12	East	East	2 a. m.	10 a. m.
November 13	Northwest	South	do	Do.
November 14	Calm	Southeast	None	

WEEK ENDING NOVEMBER 21, 1896.

November 15	Southwest	South	None	
November 16	do	do	do	
November 17	Southeast	East	do	
November 18	East	do	do	
November 19	Southwest	South	do	
November 20	West	Southwest	do	
November 21	South	Southeast	do	

[Extract from time-table of Southern Pacific Company, Los Angeles Division.]

	Distance from San Francisco.
	Miles.
Los Angeles	484.16
San Pedro	506.26
Port Los Angeles	504.56

FOR SAN PEDRO.

ST. LOUIS, November 28.

The Trans-Mississippi Congress has passed the following preamble and resolution: "Whereas, upon the completion of the Nicaragua Canal, a deep-sea harbor on the southern coast of California is indispensable to the commercial and naval necessities of the country, there being no adequate harbor facilities between San Diego and San Francisco, a distance of 600 miles of seacoast; and

"Whereas the United States Government, through its corps of army engineers, has, by its several Boards, in exhaustive reports, unanimously selected San Pedro Harbor as the most eligible site for such deep-sea harbor, and the only practicable harbor of refuge between Points Dume and Capistrano, as required by act of Congress; and

"Whereas there is an interior harbor at San Pedro which has been improved by the Government, under the direction of its engineering corps, and which has a dock frontage of more than two miles in extent: Therefore be it

"Resolved by this Trans-Mississippi Congress, That the Congress of the United States, at its coming session, be urged to provide for the construction of this deep-sea harbor at San Pedro, as already determined by the several acts of Congress, and in accordance with the several recommendations of the Boards of United States Army Engineers, as shown by Executive Documents Nos. 39 and 41 of the Fifty-second Congress, first and second sessions; and that the further improvement of the interior harbor at San Pedro be earnestly recommended."

SALT LAKE CITY, December 18, 1896.

Admiral JOHN G. WALKER, U. S. N.

Chairman of Commission to Locate Deep-Water Harbor, Los Angeles, Cal.:

The Salt Lake Chamber of Commerce, at a meeting held this day, unanimously resolved to present to your Commission, on behalf of said city and the State of Utah, the fact that this State is deeply interested in the proper location of the proposed deep-water harbor for southern California, for the reason that our citizens are engaged in an effort to build a line of railroad to connect this city with Los Angeles and the proposed harbor. This railroad when completed will be a through transcontinental line, and will be the shortest line between the Atlantic and Pacific oceans. In southern Utah, along the proposed line, and not more than 500 miles from tide water, occur vast deposits of iron ore fully equal in extent and quality to the great iron ranges of Michigan. Contiguous to these great iron deposits there exists coal measures of almost unlimited extent. Considering the scarcity of coal and iron on the Pacific Coast, and contemplating the future growth and development of the trade and commerce of that region, and of South America, Australasia, and the Orient, we deem it of the utmost importance that a suitable harbor be secured near Los Angeles by which these invaluable products of our State may reach this great and growing market. The arrangements are well advanced to commence the construction of this railroad. We expect to cooperate in the building of this line with the Los Angeles Terminal Company, and we are fully convinced that the construction of the road will be materially advanced, and, in fact, rendered certain, by the location of this deep-water harbor at San Pedro.

The chamber is so earnest that no mistake be made in the selection of the site most advantageous to this State, that it has appointed the Hon. Charles O. Whittemore to appear before your Commission and present these resolutions and to personally urge the many advantages which we think will accrue to Utah, Nevada, California, and the nation by the selection of San Pedro as the deep-water harbor for southern California.

SALT LAKE CHAMBER OF COMMERCE.
By W. A. NELDEN, *President*.

Attest:
[SEAL.]

EDWARD T. COLBORN, *Secretary*.

I appear before the Board as the representative of the Los Angeles Terminal Railway Company, a corporation with which I have been connected, either in the capacity of vice-president or attorney, since its organization.

The corporation was organized for the purpose of acquiring, owning, and leasing to larger systems of railway terminal facilities in the city of Los Angeles and upon the ocean at San Pedro Harbor. It has already spent some three millions of dollars in purchasing land and making improvements with this end in view.

It may be unnecessary to say that I shall not endeavor to touch upon any of the technical features involved in the selection of a proper site for the proposed harbor, but shall confine myself in what I shall have to say, with reference to the respective harbor locations named in the law under which your Board was appointed, to the merits or demerits of the proposed places as they may affect companies engaged in land transportation, and I shall endeavor to call your attention to those points in each location which, from a somewhat careful study of the respective locations, appear to me to be most favorable or unfavorable to the operation as successful and efficient servants of commerce at each place of transportation agencies of the kind that I represent.

It may, however, be of some assistance to the Board in understanding the points which I shall endeavor to make if I am permitted to give a short history of the development in marine and land transportation agencies which have occurred within the last few years upon the coast contiguous to the city of Los Angeles.

In the year 1880 the city of Los Angeles was a comparatively small town, shown by the census to contain, I believe, 15,000 population. This population increased with something like ordinary growth until about 1885, when the building into the city of the Santa Fe Railway afforded this country a second transcontinental line—the Southern Pacific having been the first. This was immediately followed by what was known as the “boom” period, which produced such an immense increase in population and growth in development of the country that the census of 1890 showed Los Angeles to be a city of 50,000 people and to have experienced during the decade from 1880 to 1890 a growth of 351 per cent, being the maximum of municipal growth shown in the United States for that period. The boom brought with it a large growth of commercial interests, some idea of which may be gained from the testimony of Captain Welt as to the number of deep-water vessels that found anchorage at San

Pedro during the years between 1884 and 1889, which were the years that marked the growth, culmination, and decadence of the boom. As the intense and somewhat unnatural business activity of the boom decreased, the number of vessels coming to San Pedro—at that time the only port for Los Angeles—also began to show a falling off, until by 1890 there was nothing like the amount of commerce to this part of the coast as there was during the period of the boom's existence. A considerable portion of that commerce had also been attracted to another and newer port. In the year 1887 a wealthy transportation company, which before that time had been operating on the northern Pacific Coast, purchased several hundred acres of land on the bay of Santa Monica at a place which has been referred to here as Redondo. They there erected a substantial pier, which, owing to the peculiar formation of the bottom of the ocean at that place bringing deep water close in to shore, was built at a very moderate cost. The company also constructed a line of railway from their pier to the city of Los Angeles. This pier was opened for business in the latter part of 1888, and during that year the Santa Fe Railroad also built a line connecting it with this city. I think that I may safely say that from the date that pier and the railways connecting it with Los Angeles were opened to traffic until the pier at Port Los Angeles was completed, the Redondo Pier accommodated, as a port of call, nearly all the deep-draft vessels coming to this part of the coast with consignment of general cargoes for Los Angeles, by reason of the fact that such vessels could there unload directly upon the cars without the expensive and troublesome method of lightering their cargoes to the shore followed at the San Pedro anchorage. The Redondo Pier had in addition become a regular port of call for the vessels engaged in the coast traffic between San Francisco and San Diego, and by reason of being somewhat nearer in point of time to the city of Los Angeles for the business from the direction of San Francisco it had from the first secured a large part of that traffic.

By the year 1890 the city of Los Angeles had become of such importance commercially, and the country tributary to it had increased so largely in population, that it became evident to its commercial interests that the future development of the city and surrounding country required, for the proper accommodation of its probable future maritime commerce, a harbor in the fullest sense of the term, and not a mere port of call such as had been and would be the character of the unprotected anchorage at San Pedro and the pier at Redondo. This feeling was emphasized by the fact that Los Angeles was the only point on the coast having competing lines of transcontinental railways, and by the further fact that those lines of roads afforded a shorter land route for the commerce of the Pacific islands and the Orient to the cities of the East than did any of the other railways reaching the Pacific Coast, and were not exposed to interference by storms and winter snows such as for some months of the year seriously cripple other transcontinental railways.

Impelled by these considerations, the business community of the city of Los Angeles and the surrounding country began an earnest agitation for the construction of a deep-water harbor which should be capable of accommodating in the best manner the maritime commerce which they hoped their superior railway facilities would attract. The first substantial result of this effort was that in the river and harbor act approved September 19, 1890, provision was made for the appointment of a Board of Engineers to examine the Pacific Coast between Points Dume and Capistrano with a view of determining the best location for a deep-water harbor.

On December 18, 1891, the report of the Board was made selecting San Pedro as the best site for the proposed deep-water harbor, and that report is before this Board as Executive Document No. 39 of the Fifty-second Congress.

I may say, in passing, that during the consideration by the Board of the matters submitted to them, arguments were presented favoring the two places—San Pedro and Santa Monica—the Santa Monica arguments being presented under the auspices of an organization formed in that seaside town.

Influenced by the belief that a determination of the matter submitted to the harbor Board by the act of September 19, 1890, would result in the construction of such a deep-water harbor as was sought, and in confidence that the harbor would be constructed at San Pedro, a body of Eastern capitalists prepared to organize the Los Angeles Terminal Railway Company, and purchased in the latter part of the year 1890 certain properties in the city of Los Angeles and upon the water front in the inner harbor at San Pedro, for the purposes which I have heretofore mentioned. Beginning in the early part of the year 1891, this company during the year constructed a line of railway extending from the city of Los Angeles to its properties on the bay of San Pedro. It was also a part of its scheme to promote the building of a line of railway extending from Salt Lake City and forming a connection with its terminals in Los Angeles, and at the harbor, for the purpose of giving a direct connection with this coast to about 10,000 miles of railway lines having termini at Salt Lake City, and not then, or at present, having any direct connection with this coast. This would also have had the advantage of being by about 300 miles the shortest line between this point and Eastern cities.

About the middle of the year 1888, the same year that witnessed the opening for business of the Redondo Pier, the Southern Pacific Company discontinued the work upon its pier projected into the outer anchorage at San Pedro.

The deed records of our county show that on July 30, 1891, a deed was executed conveying from Abbott Kinney to Frank H. Davis—whom it is understood from the statements made before the Board is the representative of Mr. Huntington—certain property fronting for 2,200 feet on Santa Monica Bay, commonly known and described as the Santa Monica Heights tract.

On December 23, 1891, a deed was executed by John P. Jones and Arcadia Baker, conveying to the Southern Pacific Railroad Company the right of way for a railroad which that company now uses between its tunnel and its wharf at Port Los Angeles, excepting that portion running through the 2,200 feet of frontage of the Santa Monica Heights tract, which appears to have been conveyed by Frank H. Davis by deed dated December 28, 1891.

In the latter part of 1891, or the beginning of 1892, the Southern Pacific Company began the extension of its tracks from the terminus which it had theretofore had in the town of Santa Monica to the present site of its pier at Port Los Angeles, and began the construction of that pier.

In January of the year 1892 the commercial interests of the city of Los Angeles decided to make a strong effort to secure from Congress, then sitting, an appropriation to begin work upon the deep-water harbor as recommended by the Board of 1891. In this matter the company which I represent was, of course, deeply interested, and in January of that year Mr. Charles Forman, a citizen of means and prominence in our city, as the delegate of the chamber of commerce, and myself, representing the Los Angeles Terminal Railway Company, went to Washington City for the purpose of appearing before the Senate Committee on Commerce and urging the propriety and necessity of that committee favorably recommending a measure which had been introduced by Senator Charles N. Felton, then representing this State in the Senate, appropriating about \$250,000 to begin the construction of the proposed harbor. Shortly after we reached Washington City a day was appointed by the Commerce Committee for the consideration of Mr. Felton's measure, and Mr. Forman and myself were to have had a hearing before the Commerce Committee for the purpose of urging a favorable report. When the matter was called up upon the day appointed, Senator Frye, chairman of the committee, exhibited to the committee a telegram which he had just received from the chief engineer of the Southern Pacific Company stating that the holding ground for ships in the area of the proposed deep-water harbor at San Pedro was bad, and suggesting the propriety of a further investigation upon that point when the Government undertook the large expenditure recommended by the Board of 1891 for the construction there of a deep-water harbor. This destroyed any chances for favorable recommendation which Senator Felton's measure might have had. In order that no time should be lost upon the matter, Senator Felton immediately took steps which resulted in the appointment of the Board of Engineers of 1892, Colonel Craighill chairman. The report of that Board, and the subsequent history of the matter, is probably so well known to this Board that it is not necessary for me to touch upon it.

I trust that I may be pardoned, however, in observing that, in the light of the statements which have been made upon this hearing as to the equality of merit in the holding ground at the two places, it was probably unfortunate for the interests of commerce upon this coast that the question of the possible defective character of the holding ground at San Pedro should ever have been raised, and the fact that it was raised may to some extent account for the attitude which has been assumed toward this matter by certain Members of Congress, for it is a certain fact that this matter of holding ground has been of such effect in some quarters that Senator Frye, in the speech which he made upon this harbor question on May 11 and 12 last, in the Senate of the United States, speaking of a report which an engineer had made to Mr. Huntington as to the demerits of San Pedro, said: "He [the engineer] said that a large part of the area within the breakwater was upon rocky bottom and there was no proper holding ground. On this report [continued the Senator] the Southern Pacific Railroad deserted the \$3,000,000 planted down at San Pedro and went up and planted \$1,000,000 in building at Santa Monica * * * the finest wharf or pier in the whole world." And we find the statement reiterated in Mr. Huntington's letter to Secretary Lamont of date as late as June 16 of this year (see Document F, of the typewritten documents filed by Mr. Corthell with your Board).

The outgrowth of the whole matter, after the years in which it has been under discussion, has been the appointment of this Board whom I have the honor now to address.

I think it will be seen from the foregoing that the harbor sought by the commercial interests which had begun and have prosecuted this effort to obtain a deep-water harbor upon the portion of the coast near the city of Los Angeles, was a harbor offering advantages to commerce entirely different from and much more

extensive than were offered by either of the then existing ports—San Pedro or Redondo—or any port of that character.

It was in anticipation of the construction upon this coast of such a harbor that the corporation which I represent invested its money here, and with the further anticipation that when such a harbor was constructed it would be of sufficient commercial importance to the large extent of country lying east of California to enable its promoters to offer such inducements as would secure for their terminal system a connection with the railway lines having their western termini at Salt Lake City, and for which the proposed harbor would be the nearest and best Pacific Coast port.

It may be pertinent here to quote to this Board what the Board of Engineers of 1892 said in their report as to the commercial significance of the proposed harbor. On page 4 of their report occurs the following:

"By far the most important aspect of this subject, however, is its relation to the probable future development of the deep-sea commerce of the country. Heretofore the Asiatic trade has naturally gone to San Francisco, but it has been pointed out that the construction of the Canadian and Northern Pacific railroads has introduced two competitors for the overland transportation of the Asiatic commerce. Two through lines, the Southern Pacific and the Santa Fe systems, cross the continent from Los Angeles at much lower elevations than the northern lines, and also connect the Pacific with the Gulf of Mexico, and their operation is never obstructed by snow or ice. If a safe, accessible, and convenient harbor for deep-draft vessels existed on the southern coast, these would appear the most favorable lines for the transportation of Asiatic and Australian commerce.

"Should the Nicaragua Canal be completed, the importance of the proposed harbor will become still greater. At the present time the most convenient course for sailing vessels coming around the Horn is to go out in the mid-Pacific and strike the trade winds to make the port of San Francisco. With the completion of the canal commerce will be principally transported by steam vessels of moderate draft, which will move north along the coast and seek the nearest favorable and convenient port from which their freight can reach its market.

"A deep-water harbor on the southern coast would thus receive the Asiatic and Australian freights for shipment over the most favorable transcontinental lines, accommodate a large part of the commerce passing through the Nicaragua Canal which now goes around the Horn, and finally furnish a port of shipment and supply, not only for the productive territory in its immediate vicinity, but also for the great interior plateau reached by the southern railways beyond the mountain ranges. Considering, therefore, the probable needs of commerce in the near future, the Board is of the opinion that the proposed deep-water harbor is of high national importance and well worthy of construction by the General Government."

If the provision of this Board expressed in the foregoing quotation shall be realized—and there would seem to be no reason why it may not be, and many reasons why it probably will be—the harbor which this Board is now called upon to locate will probably, at no distant date, become the most important harbor upon the Pacific Coast, commanding, as it will, the major part of the transcontinental commerce and being the first to receive for distribution over the western half of the continent the great commerce which certainly will come from the East through the Nicaragua Canal when it is completed.

In such a harbor I submit it is of paramount importance that the facilities for its use by competing lines of transportation and by all commercial interests which may desire to have access to its waters for the purpose of receiving or shipping freight should be the most extensive, convenient, and inexpensive possible. These prime necessities will, in my opinion, be impossible of attainment at the harbor which the Southern Pacific Company proposes shall be constructed by the Government in Santa Monica Bay, for the reason that there can be no competitive use, in a broad commercial sense, of that harbor.

This Board, from personal observation, is aware that the coast line facing the whole of the protected area of the harbor at that place consists of cliffs averaging about 175 feet in height, separated from the water by a very narrow strip of sandy beach in width at some places a little more than 100 feet; that for a distance of over 2 miles the only approach to the area protected by the proposed breakwater is also a narrow beach; that the Southern Pacific Company is the owner of a considerable portion of the width of this approach for all of the distance and of nearly the full width where its 100 feet width of right of way begins at the eastern edge of the protected area of the harbor. That portion of the proposed water front not owned by the Southern Pacific is shown by the map filed with this Board by Mr. Hawgood to be owned by Messrs. Jones and Baker. We have thus a proposed location for a harbor which the Government is asked to construct whose whole water front and the narrow approaches thereto are entirely owned by three proprietors.

It is true that the act authorizing the existence of this Board provides that before

the money appropriated to be expended shall be expended, the Southern Pacific Company shall execute an agreement to share equally with any other railroad company paying its proportion of the cost "the use of its pier and the approaches thereto situated westerly of the easterly entrance of the Santa Monica Tunnel."

It will be observed, however, that the provisions of the law do not extend to sharing or dividing with any company any property which it may have obtained on this water front other than that used for approaches to its present existing pier and the pier itself. It will also be observed from the maps filed with this Board by the Southern Pacific engineers that this company owns a strip of land aligning the water front of that half of the protected area of the proposed harbor extending westward and beyond its present pier. To this holding, and to any piers which may be constructed in the west half of the harbor and to which this land might be used as an approach, it would appear that this law will not apply.

It has also appeared in evidence that a person deeply interested in the welfare of the Southern Pacific Company owns in fee the land fronting the proposed harbor for 2,200 feet, extending eastward from the present pier of the Southern Pacific, which is situated exactly in the center of the proposed protected area. The ownership of this land carries with it, under the laws of this State, title in fee to mean high tide. An examination of the map which I herewith file with this Board will show that between the line of mean high tide and the southerly or ocean line of the 100-foot strip of right of way which the Southern Pacific Company has acquired through this property, there is a small line of beach constituting a sufficient holding to entitle the owner to invoke the right of accretion in asserting title to any extension of this land into the waters of the bay. This will also entitle the owner to use this land as landing places for other wharves, and those wharves and the approaches thereto over the strip of land will not be subject to the requirement of the law as to joint ownership. It is probable that for the remaining 2,000 feet next to the eastern line of the proposed protected area of this harbor the protection would not be sufficient to encourage the building of long and costly wharves in that portion. Certainly wharves located there would not be so favorably situated for the transaction of business as would be those located on the other and more protected portions of the harbor.

So, we have in this harbor a railroad company already occupying a right of way along the whole 8,000 feet of the proposed front, only half of which is subject to the law with reference to joint ownership, but all of which forms approaches to wharves which may be run out into any portion of the protected area from any part of the frontage. In addition to that, this company practically controls all of the available land for other purposes on 2,200 feet of the 4,400 feet of water front which will enjoy the maximum of protection, and such control, outside the narrow right of way from the tunnel to the present pier, is not subject to the provision as to joint ownership. Should the commerce of this port increase to an extent which will make the building of other wharves necessary under the conditions as they exist, it is not hard to imagine the occupancy by the Southern Pacific Company of practically all of the protected area by wharves which it shall construct, only one of which, and the narrow approaches thereto, would be subject to the provisions as to joint ownership and control. So that it is not going beyond the bare facts of the case to say that along the whole front of this harbor the Southern Pacific has, and will have, in spite of the provisions of this law, a superior right which no other company can afford, or will endeavor to compete with. It is unnecessary for me to call the attention of the Board to the intolerable burdens which, by virtue of this ownership of property along the whole of the front, a large portion of which is not affected by the law as to joint ownership and use, might, and certainly would, be imposed by this company on any rival company attempting to compete with it for the business of this harbor.

It has been said that a railroad company could avail itself of the right of eminent domain for the purpose of condemning over the land not owned by the Southern Pacific an entrance into this harbor. But, under the conditions which surround it, before anything like a fair competitive use of the harbor can be secured by other transportation interests, it will, I apprehend, be necessary to work a change in the sort of human nature which usually dominates and controls competing business enterprises.

It is a serious question, too, whether, under the provisions of the law, the joint right of use provided for over the present approach of the Southern Pacific to its wharf could be used by any company which might desire to go beyond that wharf and build a wharf of its own, inasmuch as the law only provides for the equal sharing of "the pier now constructed on the site of said harbor and the approaches thereto." In the absence of such a right, and upon the failure of the Southern Pacific Company to fully occupy the protected area for wharves extending out from the right of way, it might be possible for a competing railroad company to, at large expense, acquire, by condemnation, a very narrow right of way along the entire narrow approach to the harbor, and also through the land of Mr. Huntington, and so run a line into the

harbor front to a point where it could put a wharf out in the area of the protected harbor. But such condition of affairs prohibits the construction and ownership of wharves by individuals, or by an organization not endowed with the power of eminent domain for condemning lands. It is true that under the laws of California an individual or a company having obtained a franchise to construct and maintain a wharf can condemn a land approach to such wharf of sufficient dimensions to form a landing place for the wharf on the shore. But such individual or company has no power to condemn a highway for an outlet to the business of such wharf, and at the harbor in question it would be necessary for every person or corporation desiring to construct and use a wharf extending from that portion of the water front controlled by Mr. Huntington to secure in some way a control of the land lying between it and the railway right of way subject to joint use. It is difficult to see how this could be done, as the ownership of a franchise to construct and maintain a wharf conveys with it no power to condemn a way leading from it to any other point. I apprehend, however, that should the harbor be constructed at Santa Monica there would be no attempt at private ownership to wharves.

I am not advised as to the exact expenditures which the Southern Pacific found necessary in order to reach a practical depth of water at that point; but in his letter to Secretary Lamont—a copy of which is Document F of the typewritten documents filed by Mr. Corthell with this Board—Mr. Huntington, the president of that company, says: "We went to Port Los Angeles and built a great pier there which cost us, I think, about \$1,000,000."

I also notice that in the speech upon the merits of the proposed harbors, which I have referred to above, Senator Frye states that "the Southern Pacific planted \$1,000,000 in building at Santa Monica . . . the finest wharf or pier in the whole world." But however much or little the wharf may have cost, it is hardly probable that with the difficulties which might be interposed by the company now holding the superior right along the whole of that harbor in view, any private party or company will be induced to expend the very large amount of money necessary to build a wharf of over 4,000 feet long required to reach deep water at that point.

In addition to the foregoing a most serious aspect of the case is the burden upon commerce which will be entailed by the necessity of obtaining a fair return upon the investment from the commerce passing over wharves costing in the first instance so much to build, and in the second instance so much to maintain against the destructive insects which frequent the warm waters of the Pacific Coast. And it is not possible at that place to accommodate any sort of commerce, even the comparatively light-draft coasting lumber vessels, in any other way than upon a long and expensive wharf.

These conditions, I submit, are such as to make any railway company desiring to reach upon this coast a harbor which shall attract an extensive foreign and domestic commerce despair of accomplishing that end at Port Los Angeles, for the reason that it seems improbable that, under existing conditions, any commerce will be attracted to that port, save such as can be secured by the company which has already the superior rights there. And it appears quite certain that what commerce may be induced to come there will be controlled by the Southern Pacific Company through the special privileges and concessions which that company will be enabled to offer it, and which no other company can hope to equal.

Taking the Southern Pacific statement as to the cost of its own wharf, it is not going out of the way to say that the first cost of wharves necessary to be constructed in that harbor within the next ten years, should anything like a considerable business be developed there, will equal the cost of constructing the harbor itself, and this counts nothing for the enormous cost of maintaining such structures in the waters of this latitude.

But it is, I submit, not to be imagined that any considerable commerce can be enjoyed by a harbor offering no opportunities in the way of the construction of warehouses for the accommodation of such freights as can not be economically handled from the ship to the cars, and vice versa, or for affording vessels such accommodations as they may require beyond the mere furnishing to them of a place to discharge their cargoes on to cars. It is not conceivable that any harbor that has, and can have, no provisions for docking, cleaning, and repairing ships can ever be more than a mere port of call.

Persons familiar with the harbor of San Francisco know that frequently vessels come to that port over the long distances from the ports of the Pacific islands and the Orient buffeted and battered by the storms which they encounter, for whose accommodation such interior basins and docks are absolutely a necessity. It is impossible to see how such things could be afforded at the proposed harbor, and in their absence it will certainly never realize the destination as a harbor for a great national and international commerce which the conditions of competitive and cheap trans-continental railroad transportation heretofore adverted to would seem to prophecy as the future of a properly located and constructed harbor.

THE REASONS OF THE SOUTHERN PACIFIC COMPANY FOR BUILDING ITS SANTA MONICA WHARF.

The fact that the Southern Pacific Company has expended a large amount of money in acquiring its present holdings at Port Los Angeles is dwelt on at some length in arguments and in documents filed with this Board as some evidence of the fact that, in the opinion of this corporation, that location is the best upon this coast for a harbor.

My acquaintance with transportation conditions upon this coast leads me to believe that its actions in that respect are entitled to no such weight, and I think that a simple statement of the facts will demonstrate this.

Testimony has been submitted to the Board of the large commerce done at San Pedro when that was the only port for the city of Los Angeles. It has also been shown that that commerce, excepting as to certain articles handled by vessels which enter the inner harbor, has largely fallen off within the past few years.

I have already adverted to the construction of the wharf at Redondo and its connection with the city of Los Angeles by two lines of railway. It is a fact that at present the principal maritime commerce of this coast is between this city and San Francisco and way points.

The Redondo Wharf after it was open for commerce took from San Pedro about 62 per cent of this coast commerce to and from San Francisco. For reasons I have explained it also secured the larger part of the commerce brought to this part of the coast in deep-draft vessels around the Horn.

The entrance of the Los Angeles Terminal Railway into San Pedro in 1891 would divide with the Southern Pacific Company what remained of the coast commerce at that port. The Southern Pacific Company thus found itself suffering a loss of considerably more than half of the commerce which it had originally enjoyed at San Pedro, and threatened with a loss of more.

By building its pier at Santa Monica that company has returned upon the Redondo people the trick which they served upon it with reference to the commerce in the direction of San Francisco, and it has at the same time continued its competition with the Los Angeles Terminal Railway at San Pedro for the important business which continues to come to that port. It has also the further advantage in the location of its Santa Monica Wharf that no wharf can be built westward of Port Los Angeles for the reason that the topography of the country is such that no line of railway can ever reach Los Angeles beyond that point, and it will there always have the first and last call on commerce to and from San Francisco. Furthermore, no other railroad company was likely to go to the large expense of building into that place and expending something like \$1,000,000 in the construction of the costly wharf necessary to do business there for the purpose of merely dividing with the Southern Pacific Company the coast commerce which the location at that point attracts.

By building its pier at that place the Southern Pacific Company also secured a method of landing the immense quantities of coal which it uses upon its southern system, directly from the ship to the bunkers, instead of lightering it as it had theretofore done at San Pedro, and also has provided a place where deep draft vessels can unload their cargoes directly from the ship to the cars, an advantage enjoyed only by Redondo until the building of the wharf at Port Los Angeles. The advantages which the Southern Pacific Company thus gained, and will always retain, for handling the largest portion of the coast commerce in the direction of San Francisco, which commerce will of course increase greatly in the future, and in handling its coal, will amply repay it for the investment which it has made at Santa Monica without reference to the utilization of that port for the character of commerce intended to be accommodated by the harbor which it is proposed by the Government to construct on this coast. In addition to that, the possibility of using its Santa Monica improvements as a means of diverting the construction of the deep-water harbor from San Pedro, where it has to meet competing conditions, to Santa Monica, where it has superior rights which can never be overcome, was certainly worth a good deal.

In this connection I desire to quote to the Board from the speech made by Senator Perkins in the United States Senate, when the bill carrying the appropriation for this deep-water harbor, and providing for this Board, was under discussion. It may not be improper as an introduction to this to say that Senator Perkins came to this coast some forty-five years ago, as a sailor before the mast, and since that time he has maintained an intimate acquaintance with the coast of California, first as a sailor and afterwards as a shipowner, and he is to-day a member of a firm owning the most extensive line of vessels plying upon this coast.

Senator Perkins says [speaking of the Southern Pacific Company]:

"They never seriously intended building a wharf outside [meaning the outer harbor at San Pedro] until the breakwater was completed, because they had ample facilities inside for the transportation of all the freight that came there. The great objection to it was lightering. It was one of the great expenses that ships having

a heavy draft of water, more than 18 feet, could not go in over the bar at Wilmington, and the result was that the ships were obliged to anchor in San Pedro roadstead and there lighter their coal on shore. So there was a rival wharf built at a place called Redondo on the southern portion of Santa Monica Bay, and that wharf was getting a large amount of business that came from the north, because passengers and freight would reach Los Angeles City via Redondo several hours before they could on vessels coming from the north going via San Pedro. It was a wise business undertaking, and it is characteristic of the enterprise and sagacity and business foresight of the management of that great railroad company. As I have said before, for his enterprise, for his energy, for his push, Mr. Huntington is the peer of any man in this country. So he wisely said, 'We will build a wharf on this bay where we can save this lighterage.' Do you know that they use from 10,000 to 15,000 tons of coal per month that is obliged to go over their road to various distribution depots? So the railroad company decided to build this wharf at Santa Monica and save this dollar a ton lighterage which was paid to another company. It was a wise business enterprise. It was not an experiment. * * * The wharf at Santa Monica, as I have said, has been a good business investment. I believe the saving alone to the Southern Pacific upon its lighterage of coal and lumber and other supplies will amount to not less than \$15,000 and perhaps \$20,000 per month, and by reason of their facilities for doing other business, for handling merchandise coming in over the wharves from other countries, as well as our own coast States, they can handle it much more cheaply than anybody else can, and this will correspondingly add to their revenue. Therefore the building of this wharf is a splendid business investment, and I do not believe that the projectors of the wharf when they built it had any expectation of asking the Government to build a breakwater."

I don't know of a person in California who, from his own intimate acquaintance with transportation matters upon this coast, is more competent to speak upon this point than is the Senator just quoted, and it would seem that what he says is so reasonable that it should dispose of the claim which I have just been discussing.

Before passing this point it may be appropriate to notice the claims advanced by the advocates of the location at Port Los Angeles, founded upon the alleged greater nearness of that point to Los Angeles. A great deal has been made of this difference between Los Angeles and that point and San Pedro.

In a report which I have in my hand, issued by the Government, of a hearing had before the House Committee on Rivers and Harbors, on February 28, 1896, of engineers advocating the superior advantages of Port Los Angeles for a deep-water harbor, Mr. Corthell is made to state: "Southern California, of which the city of Los Angeles is the center of population and trade, has increased in population, and similarly in all other directions, about 350 per cent in the last fifteen years, and Los Angeles is only 12 miles from Port Los Angeles, where it is proposed to build the breakwater and make a protected harbor."

I am under the impression that this document has been submitted to the Board, and I know that in the matter which has been submitted to it are statements with reference to relative distances between the city of Los Angeles and Port Los Angeles and San Pedro.

I will file with the Board a time and distance table for the Los Angeles division of the Southern Pacific Railroad system, by which it operates its trains, which will show that the distance between Los Angeles and San Pedro is placed at 22.10 miles; between Los Angeles and Port Los Angeles, at 20.40 miles, being a difference in favor of Port Los Angeles of 1.70 miles, which difference would probably be increased a matter of 2 miles on all trains running from piers that might be constructed in the proposed outer harbor at San Pedro—a difference, it is unnecessary for me to say, so trifling as not to be considered in railroad transportation, and especially, as in this case, where it is more than compensated for by grades largely in favor of San Pedro, as has been shown this Board by the testimony of Mr. Hawgood.

There is also, it appears to me, another objection to the location of the harbor at Port Los Angeles and which may in its ultimate results seriously impair the usefulness of any harbor located there.

The Board will note that the map submitted to them shows that the narrow beach approach to Port Los Angeles extends for a considerable distance in front of the town of Santa Monica. This is an incorporated city, and, under the laws of the State of California, no railroad can be constructed within the limits of a municipality in this State without the consent of its board of trustees or city council. It is quite within the power of the legislative body of that city to prohibit the widening of the approach to Port Los Angeles to more than the 50 feet now already held there by the Southern Pacific Company, should that body deem a further occupancy of its beach by railroads detrimental to the interests of the city. Indeed, if the present franchise of the Southern Pacific along its right of way fronting that town calls for a definite number of tracks as one or two, that number can not be increased without the consent of the board of trustees of the city of Santa Monica.

The importance of this place has arisen from its being a very charming seaside resort, and largely the favorite resort of that kind for the citizens of Los Angeles and the surrounding country. It doesn't seem to me improbable to presume that the citizens of that town will soon find that the attractiveness of its beach, to which it is indebted for its prosperity and present importance, will be seriously impaired by any extension of the railroad use of the same. If that should come to be generally felt in that city it is hardly probable that any other line of railroad will be built there without infinite trouble, if at all. Certainly under the laws as they exist in this State the use of the proposed harbor for commerce, except what can be carried over the present lines of the Southern Pacific aligning the water front of the town, will be absolutely at the mercy of the board of trustees of a seaside village, a condition of affairs of sufficient gravity to have induced Senator White to speak very earnestly about the matter, as will be shown by a perusal of his speech on the harbor question, filed with this Board, which it seems to me would hardly encourage a large expenditure of Government funds at that place.

COMPARATIVE ADVANTAGES OF SAN PEDRO.

From the point of view of a railway company the advantages shown to be lacking at Santa Monica exist in full measure at San Pedro, and it is comparatively free from the disadvantages noted at Santa Monica.

Just here, with the indulgence of the Board, I desire to say a word as to what appears to me to be very plainly an error made by Mr. Corthell in his address to you upon last Monday in construing the force and effect of the law providing for the improvement of the inner harbor at San Pedro. After quoting certain extracts from the speech of Senator Frye, and a letter in his possession, Mr. Corthell states as his conclusion: "That is, Congress was unwilling to do any more work at Wilmington on the inner harbor if the outer harbor should be built at San Pedro, and facilities there for local commerce requiring deeper water than the present work has provided—13½ feet at low water—must be established in the outer harbor; in other words, they must abandon the inner harbor and move out."

The law from which Mr. Corthell deduced that conclusion reads as follows:

"For improving Wilmington Harbor, California, in accordance with the project submitted February 7, 1895, \$50,000: *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate \$342,000, exclusive of the amount herein appropriated [\$50,000]; but no such contracts shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and of refuge as between Port Los Angeles in Santa Monica Bay and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor."

The project referred to in that law as "the project submitted February 7, 1895," is the project of Colonel Benyaud for the attainment of 4 feet additional depth at the entrance to the inner harbor. (Ex. Doc. No. 61, Fifty-third Congress, copies of which I believe have been filed with this Board.)

How it is possible to have deduced from the wording of this law any hostility of Congress to the inner harbor at San Pedro; any expression of unwillingness to do any more work at Wilmington in the inner harbor; any notice that the inner harbor must be abandoned and its occupants move out, is something which I have been unable to comprehend.

The appropriation to begin work remains undisturbed. It is an appropriation which can not be spent for the maintenance or other expenses of the harbor, but must be spent for commencing and prosecuting, as far as the same will go, the work on the inner harbor recommended in the project of Colonel Benyaud. It is, I submit, as plain a commitment of the Government to that work as a whole as can be made in words.

The simple fact is that the location of the deep-water harbor at San Pedro will, by the terms of the law, have the effect of taking what shall remain to be done of the work upon Colonel Benyaud's project, after the \$50,000 shall have been expended, out of the continuing-contract system under which it would otherwise remain and placing it under the annual appropriation system.

The reason for this change and the way in which it came to be made amply sustain this view of the law, if any support were needed.

Since Mr. Corthell, in support of his opinion, referred to his recollection of the facts concerning this matter, I trust that I may be permitted to advert to certain of them with which I happen to be personally acquainted on account of having been present at Washington when the legislation in question was had.

The clause for the improvement of the inner harbor at San Pedro, above quoted,

without, however, that part providing for the possible lapsing of the \$342,000 continuing-contract provision, was adopted by the Senate as an amendment to the river and harbor act as it came from the House, and was in the act in that form when the bill was sent to the conference committee. That part of the bill appropriating nearly \$3,000,000 for the deep-sea harbor was also added as a Senate amendment. When the matter came up for consideration in the conference committee the clause relating to the appropriation for the inner harbor was amended by the addition thereto of the words, "but no such contracts shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and of refuge, as between Port Los Angeles in Santa Monica Bay and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor."

With that addition by the conference committee the bill was reported to the House and Senate, and passed. The records of Congress show this much. In addition to that, at the time the change was made by adding the words just quoted, I was informed by Senator White, of California, that in considering the matter the conference committee were of the opinion that in view of the large amount carried by the river and harbor bill, being as it was about \$60,000,000—one of the largest river and harbor bills ever passed by Congress—and the depleted condition of the Treasury, it was thought that if it should be decided to spend the larger appropriation at San Pedro the presence in the bill of the whole appropriation of \$392,000 for the inner harbor, would appear to constitute, when taken together, too large a sum to be given to one place. It was therefore provided that in the event of the expenditure of the larger sum at San Pedro the work upon the inner harbor project not paid for by the \$50,000 should be taken off the continuing-contract system and left to be prosecuted by future appropriations as Congress should decide.

In view of this, it would appear that the entertainment of any anxiety as to the existence of a possible sentiment of opposition in Congress toward San Pedro's inner harbor, and especially the anticipation that the tenants of that harbor are in danger of being served with a notice from the Government to move out, is an entirely uncalled for exercise of sympathetic anticipation.

The blue print filed with this Board by Mr. Hawgood, with the intention of showing the ownership of the water front upon the westerly side of the inner and proposed deep-water harbor at San Pedro, was made up from data collected from the public records of the county, and its correctness can be fully demonstrated if there is any disposition upon the part of anyone to question it. It shows such a diversity of ownership of the frontage of the inner harbor as to demonstrate beyond a question the absolute impossibility of any monopoly of its advantages, not counting the fact that the eastern water front of the inner harbor is also subject to other ownership. It will be noted that by that map the Southern Pacific Company is shown to own a considerable strip of land aligning that portion of the proposed outer harbor from which wharves can be most easily projected.

It has been claimed here that the Southern Pacific holdings on the water front of the proposed deep-water harbor at San Pedro tend to give that company a monopoly of its advantages. I think the inspection which this Board has already made of that location has probably shown you that the topography of the country west of the Southern Pacific holdings, is such as not to offer any serious difficulties of approach by any other railway company that may desire to reach the harbor front by crossing the Southern Pacific track.

The mesa or high plain lying west of the proposed deep-water harbor and under the Palos Verdes Hill also affords several hundred acres of ground excellently adapted to the construction of warehouses and storage depots for any commerce which it may be necessary to handle to and from the deep-water harbor. As to the inner harbor, the opportunity afforded to shippers for securing these apparently necessary adjuncts to the commerce of a large seaport is practically unlimited.

In addition to that, another advantage, entirely lacking at Santa Monica, and as to whose necessity in connection with such a harbor as it is desired to secure there can, it seems to me, be no two opinions, exists in perfect form at San Pedro. I mean the opportunity for docks and interior basins where ships may be placed for cleaning and repairing. The 18 feet of water over the bar at the present time would enable almost any vessel to go into the inner harbor after her cargo was discharged, and when that depth is increased to 22 feet by the completion of the Benyard project, there would appear no reason why any ship of commerce which sails the ocean might not find inside all such accommodations for dockage and repair as could be needed after the longest or hardest voyage.

Reference has been made in what I have quoted from the report of the Board of 1892, and also in quotations which have been made to the Board from Senator Frye's speech, to the relation which the proposed harbor will sustain to the commerce coming through the Nicaragua Canal when that enterprise shall have been completed, as it is confidently hoped and believed through all the western portion of the

United States will be done before many years. When that time arrives an immense commerce will undoubtedly come to this coast from the eastern coast in vessels of comparatively light draft constructed especially with reference to that service. It would not appear probable that any considerable percentage of this commerce will be done by vessels which could not enter the inner harbor at San Pedro, when the depth of 18 feet of water at mean low tide is secured by completion of the Benyard project. With the accommodations which the location of the deep-water harbor at San Pedro, and the advantages which can be obtained there by the improvement of the inner harbor, would give to that commerce, and the distributing advantages offered for that commerce by the two lines of transcontinental railroads already in Los Angeles, and the third which will probably be secured as a connection with the Terminal before the canal is completed, it would appear that the port through which a large part of the Nicaragua Canal commerce will be distributed to that portion of the United States lying west of the Rocky Mountains will be the port at San Pedro. That port will then for that commerce, as compared with Port Los Angeles, enjoy any superiority in time between the seacoast and the city of Los Angeles that Port Los Angeles now enjoys with reference to the up-coast commerce to San Francisco, and the latter will certainly be much less important and worthy of accommodation than the commerce which we may expect through the Nicaragua Canal.

From the foregoing considerations the corporation with which I am connected, and I think I may say every other railroad interest centering in this city save the Southern Pacific, feel that the interest of the railway lines now existing or hereafter to be built to this part of the coast requires the location of the proposed harbor at San Pedro, for the reasons, first, that it is infinitely more accessible for railroad lines; second, that there is no such superior right owned there by another railroad company as would become very burdensome upon competing lines; third, because it affords in the largest measure accommodations for such commerce as is desirable to attract to such a harbor, and will therefore attract a larger commerce of which railroad companies will have their share than will the other proposed location.

REMARKS OF W. C. PATTERSON.

ADMIRAL WALKER AND GENTLEMEN OF THE HARBOR COMMISSION: I appear before you as a business man engaged in a business which now involves a large amount of shipping and which is capable of expansion. I also appear as a representative of the Free Harbor League, an organization composed of a large number of our most prominent and active business and professional men. The league was organized for the purpose of securing the construction of a deep-water harbor which would be accessible to as many railways as may wish to come to the water front. It was the belief that only such a harbor would best subserve the interests of this great and growing community and at the same time be of incalculable benefit to transcontinental commerce.

I am not informed as to whether the desires of our citizens will be a factor in the determination of the problem which you are to solve, but I confidently assure you that there is practically but one sentiment among the people who are engaged in active business enterprises in this community, and that sentiment is in favor of San Pedro.

I desire to file with you a document which expresses the desires of those whose opinions we who know them believe to be entitled to great consideration. The signatures are of those who comprise practically every commercial interest in this community. Among these are representatives of every bank in this city save one, and that bank had a satisfactory reason for not uniting with the others in this matter. The ratings, as shown by the commercial agencies, show that those engaged in active commercial enterprises who have signed this document represent an aggregate capital of about \$15,000,000. The strong and overwhelming sentiment in favor of San Pedro must be due to the fact that there exists in the minds of a multitude of men strong reasons, gained by experience and their knowledge of the business of this section of the country.

Whatever may be said by way of theory, the common-sense people of Los Angeles believe that the only harbor approachable on all sides is the harbor at San Pedro. It may be approached at right angles, where other railroads can be built across any road which may now or hereafter align the outer harbor frontage, and so reach the area of the outer harbor.

The people of Los Angeles believe that it would be of advantage that a harbor should be constructed at such a locality in preference to one which may be subject to the control and domination of any corporation or corporations which chance to have the right of way. It has been suggested to me that the regulations of the

municipality of Santa Monica can protect the absolute use of approach to a harbor in that vicinity, and embarrass, if not prohibit, any other railroad which may desire to enter. It has been admitted, if I am not mistaken, that a very large portion of the front of the area of land contiguous to Port Los Angeles is owned by a person closely connected with the railroad company which now occupies the entrance to Port Los Angeles. It is possible that this fact would furnish opportunity for discrimination and for burdensome exaction upon the commerce intended to be served through the harbor. I do not attempt to say that such discrimination would be made, but I can conceive of conditions under which it could be made to an extent well-nigh intolerable.

In order to accommodate commerce it is necessary that a harbor should be large and easy of access. It should supply facilities for the construction of warehouses where freight to be shipped may be stored pending the arrival of bottoms in which it is to be shipped, and where freight unloading may be stored for distribution and for future handling, without the necessity of at once rushing it from the point where it is unloaded. In addition to this, the cost and opportunities for private ownership of wharves and warehouses at the harbor are of very great importance. It has been stated by parties connected with the wharf at Port Los Angeles that that great work cost something near \$1,000,000. This statement has been confirmed by a letter from Mr. Huntington to the Secretary of War, to which letter reference has already been made to your honorable Board. Whatever its cost may have been, it would be folly to say that any commerce can be done to-day at Port Los Angeles, or can be done in future, except it be over a wharf extending a long distance from the shore. Such a wharf at best is very costly to construct under the peculiar conditions affecting wharf piling on this coast. So costly indeed must these structures be, even under the protecting conditions of a breakwater, that the idea of private ownership is forbidden, and the real ownership and control of wharves at that locality must of necessity be in the hands of large and wealthy corporations.

I do not believe that a proper harbor for commerce can be created where the wharves and their surroundings are confined to any one corporation, whatever may be its name. Our people have hoped that the Government would afford such a harbor upon this coast as will attract to it a class of commerce now going to more southern ports, namely, the commerce of the Orient. Such a commerce would find, at a proper harbor constructed for Los Angeles, two or more lines of railway which would carry it to the Eastern States over lines of easier grades and with less interference during the winter storms. No better place can be found on the western coast of America for the establishment of such a harbor than at San Pedro.

It appears to me that the ships which bring freight over thousands of miles of stormy seas must have offered to them, by the harbor to which they are destined, opportunities for refitting and recovering themselves from the damages and injuries incident to long voyages. This essential feature can not exist at Port Los Angeles. At San Pedro the opportunities for the proper construction of docks are abundant. These conditions will exist to a still greater extent when the project submitted by Colonel Benyaud and approved by the Government for obtaining an additional depth of 4 feet over the bar, making a total depth of 24 feet at high tide, has been carried out.

A very strong recommendation for the location of the outer harbor at San Pedro is the fact that the Government has now at that point expended \$1,000,000 in the development of an inner harbor, which it will, no doubt, continue to maintain and improve. A harbor at Santa Monica would necessitate the maintenance of two harbors instead of one. The Government would necessarily have to care for and maintain two different projects, whereas if the outer and inner harbors are both established at San Pedro both can be cared for under the same appropriation and under the same management. To me it seems that it is beyond dispute that an outer harbor can be constructed more cheaply and can be utilized more fully and more satisfactorily at San Pedro than can any harbor located at Port Los Angeles.

I would say in conclusion that the business community of Los Angeles, whom I represent, is in its opinion entirely in accord with the conclusions reached by the Board of Engineers of 1892 as to the proper place for the establishment of a harbor for the future developments of trade on this coast. We believe that the Nicaragua Canal will be constructed. We believe that when the canal is constructed the larger portion of the commerce which this harbor will be called upon to take care of will come from the eastern coast, and will find its first distributing point at the locality which this Board shall select, providing that it is one which will accommodate that commerce.

The people of Utah, who have conferred upon me the honor of representing them before this Commission, feel that they have an interest in the location of the proposed deep-water harbor second only to that of the people of southern California.

There are two aspects of this question, both of which will doubtless receive full consideration by this Board. One is the maritime situation; the other equally as important, is the commercial situation. Utah's interests are to be regarded from the commercial standpoint, and I shall therefore confine myself to that branch of the discussion.

When the citizens of Salt Lake were advised of this hearing, a meeting of the chamber of commerce was held to take some action in the matter, and as a result a set of resolutions were adopted, which I now take the pleasure of presenting to you.

[Resolutions.]

SALT LAKE CITY, December 18, 1896.

Admiral JOHN G. WALKER, U. S. N.,

Chairman of Commission to Locate Deep-Water Harbor, Los Angeles, Cal.:

The Salt Lake Chamber of Commerce, at a meeting held this day, unanimously resolved to present to your Commission, on behalf of said city and the State of Utah, the fact that this State is deeply interested in the proper location of the proposed deep-water harbor for southern California, for the reason that our citizens are engaged in an effort to build a line of railroad to connect this city with Los Angeles and the proposed harbor. This railroad when completed will be a through trans-continental line, and will be the shortest line between the Atlantic and Pacific oceans. In southern Utah along the proposed line, and not more than 500 miles from tide water, occur vast deposits of iron ore, fully equal in extent and quality to the great iron ranges of Michigan. Contiguous to these great iron deposits there exist coal measures of almost unlimited extent. Considering the scarcity of coal and iron on the Pacific Coast, and contemplating the future growth and development of the trade and commerce of that region, and of South America, Australasia, and the Orient, we deem it of the utmost importance that a suitable harbor be secured near Los Angeles by which these invaluable products of our State may reach this great and growing market. The arrangements are well advanced to commence the construction of this railroad.

We expect to cooperate in the building of this line with the Los Angeles Terminal Company, and we are fully convinced that the construction of the road will be materially advanced, and in fact rendered certain, by the location of this deep-water harbor at San Pedro.

The chamber is so earnest that no mistake be made in the selection of the site most advantageous to this State that it has appointed the Hon. Charles O. Whittemore to appear before your Commission and present these resolutions, and to personally urge the many advantages which we think will accrue to Utah, Nevada, California, and the nation by the selection of San Pedro as the deep-water harbor for southern California.

SALT LAKE CHAMBER OF COMMERCE,
By W. A. NELDEN, *President*.

Attest:

EDWARD F. COLBOHN, *Secretary*.

Not only do these resolutions express the sentiments of the Salt Lake Chamber of Commerce, but they voice the unanimous opinion of the people of the entire State.

There is a fundamental principle of law as well as of political economy that in the expenditure of public funds it is the duty of the servants of the people in whom the trust is imposed to so use the fund as to insure the greatest good to the greatest number. If, therefore, this Commission can, by the selection of San Pedro as a site for a deep-water harbor, benefit the whole people of southern California, and of Nevada and Utah as well, while by selecting Santa Monica enhance the interests practically of one corporation, then, all else being equal, its duty is plain in the premises and will no doubt be performed. When I say that the selection of San Pedro as a deep-water harbor will benefit the whole people of southern California, Utah, and Nevada, while the selection of Santa Monica will only inure to the advantage of a single corporation, I speak advisedly, and propose to demonstrate the correctness of my statement. This contest is a battle being waged by the people on one side for San Pedro, as against the Southern Pacific corporation for Santa Monica on the other. This must have become apparent already to the members of this Commission by the fact that no one except the agents, employees, and servants of the Southern Pacific have, either by word or act, espoused the cause of Santa Monica, while on the other hand it will be demonstrated to you as the hearing progresses that the people, not only of southern California but of the whole trans-Mississippi country, are advocating the cause of San Pedro.

Why this condition exists it is not difficult to explain. San Pedro as a harbor offers facilities for trade and commerce that Santa Monica does not possess. With San Pedro as a harbor, the people generally can enter into commercial relations with

Central and South America and the Orient without being at the mercy of a corporation as soulless and as grasping as any that was ever known to exist.

We predict the future conduct of an individual by what he has done in the past; and in the same way the people of southern California, Nevada, and Utah know what the course of the Southern Pacific will be if it gets this appropriation for a harbor at Santa Monica just as well as they know the manner in which the people have been dealt with in every case where the Southern Pacific has held the vantage ground. It would be a monopoly in the fullest sense of that word. It is true that the law of Congress authorizing this expenditure provides that if the Board reports in favor of Santa Monica the Southern Pacific is required to enter into an agreement so that any railroad company may share equally with the Southern Pacific Company the use of the pier now constructed on the site of said harbor and the approaches thereto, situated westerly of the easterly entrance to the Santa Monica Tunnel, upon its paying a proportionate cost of that part of the pier used by such railroad company and its proportionate expense of maintenance of the particular part of the pier and approaches so used. But it is needless for me to remind the members of the Board who, as engineers, have had experience in railway construction and management, that in the rivalry always existing between competing railway lines such restrictions and conditions can be imposed upon the company whose interests are subordinate as to render such a franchise valueless and make that part of the law nugatory.

Utah is interested in the selection of this harbor because the people of that State are engaged in an effort to build a line of railway between Salt Lake City and Los Angeles which, when completed, will form part of a transcontinental system and be the shortest line between the Atlantic and Pacific oceans. Such a line would become one of the great arteries of trade and commerce in the United States, and in connection with a proper harbor it would be the means of extending that trade to South America and the Eastern empire. Such a trade will, in the course of time, become enormous in its proportions, and harbor facilities of the most extensive character will be an absolute necessity. If a place is selected that will not meet these requirements, then the purpose of this appropriation of public funds will fail. If a site like Santa Monica is selected for this harbor, which can never become anything more than a port of entry and discharge, then instead of being one of the world's leading commercial ports, the harbor would remain practically what it is now—a place where coastwise and tramp steamers could take on and discharge their cargoes, provided the wind was not too strong and the waves were not running too high. For the trade and commerce that this port would have if properly located, there should be unlimited opportunity for the building of extensive warehouses, wharves, and docks, and with as little expense as possible, so that the merchant and tradesmen of limited means would have an equal opportunity with the corporation backed by its millions. It should be a place where warehouse and wharfage privilege could be obtained without paying charges such as would have to be exacted to return a reasonable percentage on the vast sums that would have to be invested at Santa Monica to afford any commercial advantages whatever. These charges would be practically prohibitory in so far as the smaller merchants are concerned, and especially would this be true with regard to the shipping of bulky products handled on close margin, such as coal, iron, lead, copper, sulphur, soda, salt, asphaltum, etc.

Utah is interested in the location of this harbor for the further reason that along the proposed railway line, and not more than 500 miles from tidewater, occur large deposits of iron ore. These ore bodies are so vast in extent and so pure in quality as to excite the wonder and admiration of the leading geologists of our country. Professor Newberry, in a report that I will file with your secretary, says of them:

"The deposits of iron ore near Cedar City, in southwestern Utah, are probably not excelled in intrinsic value by any in the world. There are certainly no other deposits to compare with them west of the Mississippi for the manufacture of pig and bar iron and steel, and it would be difficult to estimate the influence they will eventually have on the industries of the Pacific Coast."

Prof. W. P. Blake, in a report, says: "Utah's iron resources must exceed those of any other section of the Union."

[The United States Baldwin Exploring Expedition report.]

"Utah's greatest wealth lies not in its hundreds of gold and silver ledges, but in its iron and coal fields. The seemingly fabulous stories of the immense iron deposits in southern Utah but told part of the truth. The district is one vast extent of rich magnetic and hematite ores. The ledges crop out of the earth in places hundreds of feet high, and appear on the surface for 800 or 1,000 feet. But a few miles distant are immense bodies of coal with which to melt out this huge body of material wealth."

Japan, one of the coming commercial and industrial nations of the world, is to-day in search of just such iron as exists in southwestern Utah to meet the demands of her rapidly increasing manufactories. To engage in this branch of trade with Japan

and the South American countries, the people of Utah must have a port where warehouse and wharfage facilities are extensive and where the products of iron can be handled with the smallest expense possible.

Utah's interest in the proposed harbor arises also from the fact that there exist coal measures of almost unlimited extent within her borders. With opportunities for export, such, for instance, as will arise on the completion of the Salt Lake and Los Angeles Railway and the establishing of a deep-water harbor in connection with it, the coal trade that will follow will be something enormous. With a coal area of not less than 5,000 square miles, there will be absolutely no limit to the capacity for production. When it is realized that there are no coal mines between Utah and the Pacific Coast, and that we are able to supply the entire California demand, as well as that of other countries where coal is required, you will appreciate our interest in having a harbor selected that will make this vast business enterprise a possibility.

In addition to iron and coal, and equally valuable, are our great bodies of asphaltum and the hydrocarbons. These deposits cover an area of about 13,000 square miles, and contain sufficient asphaltum and enough of the hydrocarbons, elaterite, gilsonite, and ozocerite to supply the world for centuries to come. The refined asphaltum produced in these fields is superior to any other form of asphaltum produced in the world. Its analysis is 99 per cent pure, while the Trinidad asphaltum is a coarse article as compared with it, being only 30 per cent pure. All the largest varnish makers in the United States now use this Utah asphaltum for the manufacture of the highest grades of black japan and asphaltum varnishes. All black japanned tin for signs, etc., are prepared with it, and gilsonite is used for street paving and, in a refined state, for all fine black varnish work, to the exclusion of all other kinds. These products will, therefore, form a valuable adjunct to our foreign commerce, and will need cheap and extensive harbor facilities. Excellent sulphur mines also exist in several parts of the State. In Millard County, near the proposed railway line, the deposits of sulphur are far richer and more abundant than in Sicily. The present production is 50 tons of pure sulphur per day. This output will be much greater when better facilities for export are obtained. Plaster of paris is being extensively manufactured from the deposits of gypsum, and already large quantities have been shipped to California.

Salt to the amount of 100,000 tons per annum is gathered along the shores of Great Salt Lake and shipped to various parts of the United States, where it is used for milling and manufacturing purposes. Its uses will be extended as we build up a foreign trade.

Utah wants an opportunity to distribute throughout the world the mineral wealth that nature has supplied her with. She can only do this through a port such as it is hoped this Commission will establish. We do not come to champion the cause of one railway company as against another, nor to take part in any local contention. Our mission is to promote the trade relations with foreign countries. We do not want to be placed at the mercy of the Southern Pacific Company or any other corporation. We do, however, want a harbor that will afford the people of our State an opportunity to enter into free and unlimited commercial relations with trans-Pacific countries. We are fully convinced that San Pedro as a harbor will meet all these requirements, but that Santa Monica will afford us nothing.

SAN FRANCISCO, December 31, 1896.

THE HONORABLE BOARD OF DEEP-SEA COMMISSIONERS:

Learning that your honorable Commission is now investigating the harbors of San Pedro and Santa Monica, I take the liberty of writing you, giving a few personal observations concerning them derived from a thirty years' navigating experience on the Pacific Coast.

From the Straits of Fuca south to San Diego there is not a harbor a ship can enter in bad weather or when in distress, for they are bar harbors, with moving sands both outside and inside of the bars. The greatest difficulty met by engineers, and which has caused them close study, has been to confine the channels and tides in some narrow, straight direction, so as to deepen the channel, which has cost the Government large sums of money.

Some twenty years ago it was not uncommon for a ship to be bar bound from four to six weeks on the Columbia River. Now they are seldom bar bound longer than from eight to ten days. During the time I have navigated the Pacific Coast I have known five different channels at the mouth of the Columbia River. One of these has in later years been converted into an island. Along the entire coast like changes have proportionately taken place.

There are some fourteen or fifteen outside landings between San Francisco and

San Diego that have wharves built out about the same as that at Redondo. At these wharves steamers and sailing vessels land and discharge, except during heavy weather, when it is an impossibility for a vessel to make a landing at any of the wharves along the coast. When steamers and sailing vessels can not land at Santa Monica or Redondo they proceed to San Pedro, where they can make a landing.

Out of any of the fourteen outside landings along the coast has there been so much trouble as at Santa Monica Bay with the wharves. Not a winter passes but more or less damage has been done to either the wharf or vessels, and sometimes to both vessels and wharf.

Two years ago the sands were washed away from the inner end of the wharf, destroying that part, but leaving at Redondo the outer end standing, and had it not been for the staunchness and great care which have been taken of the Santa Monica wharf, that would have gone, too. If a wharf should be extended out from any outside port half the distance that the Santa Monica Wharf is, it would answer just as well as that at the latter place, for they would be equally exposed to their greatest enemy—the west and southwest sea—on this coast.

It is not the southeast winds that do the damage on the coast and make our bars and landings rough. It is after the wind changes to the west and southwest that there are blows of the greatest fury at times. If we should get a southwest gale such as we have frequently had on the coast, ships now at Santa Monica would be scattered along the beach and neither property nor lives be saved.

Southeast gales blow about two or three points offshore at San Pedro and about six or seven points at Santa Monica Bay, while in Santa Barbara Channel the regular southeast gale blows a little off land. Experience teaches that nothing less than a properly built dock will answer.

At Callao, Peru, a French company's first intention was to run a breakwater north and south, thinking that a vessel could lie inside, but it was found that the breakwater increased the undertow to such an extent that it was impossible to hold any vessel at all. So they built a dock closed in all around, leaving a narrow entrance to the north, and yet the undertow is so great that at times it is impossible to hold a ship so as to discharge or load. The Dock Company furnish all ships with fastenings, and have at hand a crew of men for the purpose of mooring and unmooring ships.

A breakwater run out in any direction where the bottom is of a quicksand nature, and where there is no current running in any straight direction to keep the harbor open and in place, the whole would in time grow into a peninsula. For an example, see the east arm of San Pedro Harbor, where a breakwater was run out to Deadman's Island for about 2 miles, and when completed had blue water on both sides, and now it is growing sands to the east.

In no place on the coast has there been such substantial work done by the Government in improving the harbor as has been done at San Pedro. When they commenced to improve this harbor there was about 4 feet of water on the bar. Now there are 18 feet, and it is deepening all the time. Point Firmin runs out in a southerly direction, which affords protection to the bar from westerly swells and causes the course of the current to be the same year in and year out. The rocky reef extending out from Point Firmin offers excellent foundation for a breakwater, and with the same harbor regulations as to mooring ships, San Pedro to-day would be a better harbor than Valparaiso. One is open to the north, the Pacific Ocean, and the other to the south. San Pedro is sheltered from the worst seas on the Pacific Coast.

I read in the newspaper a statement made by Mr. C. P. Huntington, at Washington, D. C., concerning the two places, in which he said there was no holding ground at San Pedro, whereas the truth is the bottom is just about the same there as it is at Santa Monica, being a little more rocky, which the chart will show. It is very true that two or three ships have gone ashore there, but that can not be attributed to bad holding ground. The ships *America* and *Kennebec*, which went ashore, were deep-water vessels, and on arriving at San Pedro they discharged their crews, and at that time that port had no pilot or harbor master to acquaint strangers with the port or order the proper mooring of vessels. When the breeze sprung up the mate of the *America* lifted the compressor on the windlass to give the vessel chain, thinking the end was made fast, and when the rattling of the chain stopped he looked over the bow and discovered that the anchor and chain had left him. The ship then swung around and beat her way in over the bar with one anchor on the bow. She is running to-day.

The *Kennebec* went ashore also with one anchor on the bow, but was afterwards raised. She is running also to-day. The masters of both vessels were on shore at the time of the accidents, while there was no crew on either vessel. The ships swing to a land breeze in the night and to the sea breeze in the day, in this way fouling their anchors.

Respectfully submitted.

C. F. SWAN,
Master Bark Theobald.

TITLE GUARANTEE AND TRUST COMPANY,
Los Angeles, Cal., April 7, 1896—8 a. m.

T. E. GIBBON, Esq., City.

DEAR SIR: The Title Guarantee and Trust Company has made a careful examination of the deed records of Los Angeles County, State of California, and finds that Frank H. Davis acquired the following-described property, by bargain and sale deed, from Abbot Kinney, trustee, and Abbot Kinney, individually, dated July 30, 1891, and recorded in book 745, page 15, of deeds, and that he has made no conveyance of the same of record, except a strip 100 feet wide along the shore line of Santa Monica Bay which he conveyed to the Southern Pacific Railroad Company, a corporation, by grant deed dated December 28, 1891, and recorded in book 769, page 102, of deeds.

DESCRIPTION.

A portion of the Rancho Boca de Santa Monica in the county of Los Angeles, State of California, allotted to Francisca M. de Rios de Pena in the suit of partition entitled Robert S. Baker v. Manuel Marquez et al., in the county of Los Angeles (case No. 2405), and particularly bounded and described as follows:

Beginning at a post, station No. 21 of allotment No. 1 to R. S. Baker et al., and running thence along the left and easterly bank of Sanjon del Protrero south 17° 12' west 7.24 chains to a stake, station No. 2; thence south 77° 16' east 1.66 chains to a stake, station No. 3; thence south 8° 51' west 26.07 chains to a stake, station No. 4; thence south 39° 57' west 1.05 chains to a stake, station No. 5; thence south 80° 47' east 4.12 chains to a stake, station No. 6; thence south 42° 21' east 3.68 chains to a stake, station No. 7; thence south 13° 38' west 3.90 chains to a stake, station No. 8; thence south 30° 43' east 15.25 chains to a stake, station No. 9; thence south 16° 24' west 7.30 chains to a stake, station No. 10; thence south 47° 05' west 5.43 chains to a stake, station No. 11; thence south 23° 24' west 14.01 chains to a stake, station No. 12; thence south 12° 10' east 3.80 chains to a stake, station No. 13; thence south 74° 04' west 2.68 chains to a stake, station No. 14; thence leaving Sanjon del Protrero south 60° 43' east 8.94 chains to a stake, station No. 15; thence south 54° 30' east 24.34 chains to a stake, station No. 16; thence north 53° 12' east 8.45 chains to a post, station No. 17; thence north 46° 40' east 7.78 chains to a stake, station No. 18; thence north 51° 02' east 3.32 chains to a stake, station No. 19; thence north 22° 28' west 2.30 chains to a stake, station No. 20; thence north 39° 08' west 2.38 chains to a stake, station No. 21; thence north 38° 34' west 2.55 chains to a stake, station No. 22; thence north 57° 55' west 4.83 chains to a stake, station No. 23; thence north 30° 22' west 7.05 chains to a stake, station No. 24; thence north 14° 53' east 12.66 chains to a stake, station No. 25; thence south 77° 35' east 5.13 chains to a sycamore tree, station No. 26; thence north 20° 56' east 4.06 chains to a post, station No. 27; thence north 39° 45' west 5.74 chains to a stake, station No. 28; thence north 15° 23' east 16.45 chains to a stake, station No. 29; thence north 16° 20' west 2.42 chains to a post, station No. 30; thence north 45° 50' west 50.90 chains to the place of beginning, containing 247.60 acres of land, more or less; reference being had to a certified copy of said decree of partition aforesaid, recorded in the recorder's office of the said county of Los Angeles, in liber 102 of deeds, page 397. Excepting therefrom, however, lots 7 and 8, in block BB, and lots 9 and 10, in block DD, Santa Monica Heights (a subdivision of said tract of land), according to a map of said subdivision, recorded in book 37, page 52, of miscellaneous records of Los Angeles County, which said lots 7, 8, 9, and 10, aforesaid, have heretofore been sold and conveyed to other parties.

Said property has a frontage on Santa Monica Bay of about 2,200 feet, extending easterly from the wharf.

Yours, truly,

[SEAL.]

TITLE GUARANTEE AND TRUST COMPANY,
By E. W. SARGENT, Vice-President.

SAN FRANCISCO, November 28, 1896.

To the Board of Harbor Commissioners for Locating a Harbor at San Pedro or Santa Monica on the Coast of Southern California.

DEAR SIR: The undersigned will respectfully represent that they are residents of the city of San Francisco and extensively interested in the commerce of the Pacific Coast, being owners of vessels engaged in coastwise commerce between the ports of that coast; that from their observation and experience they are strongly impressed with the superiority of San Pedro as a location for the proposed harbor for the accommodation of the commerce of the city of Los Angeles and southern California for the following reasons, among others:

First. That there is now at San Pedro a completely land-locked harbor, which will

accommodate vessels of 18 feet draft, and a moderate expenditure upon said harbor of the character heretofore recommended by the Government officials in charge will improve it sufficiently to accommodate vessels of 25 feet draft, which draft is as great as any now engaged or likely to be engaged in the commerce of this coast for some time in the future.

Second. That the construction of the proposed breakwater at Santa Monica can never produce a harbor in the commercial sense of the term, for the reason that there is no possibility of securing interior docks or basins at that place; that the area protected by the proposed breakwater of sufficient depth to accommodate vessels of considerable size will be very circumscribed, and, most important of all, the cost of extending wharves from the shore to a depth of water which will accommodate vessels of considerable draft is so enormous, being, according to the estimates of the Southern Pacific of the cost of its wharf at that place, something like \$500,000, that the proposed harbor at that point would in no sense be open to general competition, and its benefits would necessarily be confined to large and wealthy corporations or companies, who could build the extensive wharves demanded by the conditions at that place.

Wherefore, the undersigned would respectfully request that the harbor proposed for southern California be located and constructed at San Pedro.

Signed by F. P. and I. W. Hooper and 22 others.

JOHN F. FRANCIS,

President Free Harbor League, Los Angeles, Cal.:

WASHINGTON, D. C., December 21, 1896.

Have been informed that Mr. Corthell, the railroad engineer, claims that he is in possession of a statement from a member of the Commerce Committee to the effect that the Board now in session in Los Angeles was so appointed as to require absolute exclusion of all consideration of inner harbor at San Pedro. Such an assumption is unwarranted, and is in harmony with the arrogant impudence which has throughout characterized that side of the controversy. The statute will govern the Commission, and the gentlemen composing it will undoubtedly follow the obvious requirements of the river and harbor bill, which demand a location of the harbor at the most desirable point. If the inner harbor constitutes a determinative element in solving the matter of eligibility, there is no law requiring the Board to exclude this important factor. The requirements of the situation imperatively necessitate the most beneficial location, and this involves the consideration of all circumstances, be they great or small. No letter from any Senator or Congressman can define or limit the duty of the Board. No dictation from any source, near or remote, can legitimately prevent the fixing of the improvement at the most suitable place. The act of Congress does not demand or permit the exclusion of those advantages which the Almighty has accorded without consultation with the Southern Pacific.

Please send me copy of Mr. Frey's letter.

STEPHEN M. WHITE.

Rear-Admiral John G. Walker, Chairman, and Members of the Deep-Water Board for Southern California.

GENTLEMEN: The Pasadena Board of Trade, representing a city of 12,000 population, begs to submit herewith a copy of the resolutions unanimously adopted at a meeting of said board December 23, 1896, to wit:

"Whereas the Deep-Water Harbor Board now in session in Los Angeles has been appointed to determine upon the location of a harbor to be constructed by our National Government, either at San Pedro or Santa Monica; and

"Whereas said harbor should be so located and constructed as to accommodate to the fullest extent not only our rapidly growing coast trade, but our international commerce. It should afford not only anchorage for vessels and facilities for receiving and discharging their cargoes, but ample provision should be made for the erection of warehouses, building of repair docks, construction of interior basins and shipyards, and the appliances that are required by the shipping interests usually centered at a great harbor, as well as the freest possible access for the agencies of land transportation which the commerce of such a port will require; and

"Whereas it is the sense of this board that the site in San Pedro Bay heretofore selected by other Government experts affords superior facilities in regard to such requirements: Therefore, be it

"Resolved, That the Pasadena Board of Trade recommends San Pedro Bay as the most favorable location for such a harbor.

"Resolved, That these resolutions be signed by the president and secretary and spread upon the minutes of the board of trade, and that a committee be appointed to submit a copy hereof to the Deep-Water Harbor Board."

COLIN STEWART, *President.*

FRANK P. BOYNTON, *Secretary.*

Winds at San Pedro, from records at Point Firmin light-house.

		North and north- erly.	North- east.	East and east- erly.	South- east.	South and south- erly.	South- west.	West and west- erly.	North- west.	Varia- ble.	Total
1890.											
January	(A. M.)	8	1			2		1		10	31
	(P. M.)	1	1	1	1	3				24	31
February	(A. M.)	9	1			1		1		16	30
	(P. M.)		1							23	31
March	(A. M.)	17			1			4		22	31
	(P. M.)	5				2		2	1	10	31
April	(A. M.)	7		1		1		4	2	19	31
	(P. M.)					2		1		19	30
May	(A. M.)	9				2				28	30
	(P. M.)							3		19	31
June	(A. M.)	4				3		14		17	31
	(P. M.)								5	19	30
July	(A. M.)					3		2	3	22	30
	(P. M.)										
August	(A. M.)										
	(P. M.)										
September	(A. M.)										
	(P. M.)										
October	(A. M.)										
	(P. M.)										
November	(A. M.)										
	(P. M.)										
December	(A. M.)										
	(P. M.)										
Total		60	4	2	2	17		32	11	234	362
Per cent of directed winds		46.8	3.1	1.6	1.6	13.3		25.0	8.6		100.0
1891.											
January	(A. M.)	20		1						7	31
	(P. M.)		3		1			3	1	23	31
February	(A. M.)	8		1	2			2		15	30
	(P. M.)	1		2	1	2	1			21	31
March	(A. M.)	4			1			1	2	23	31
	(P. M.)				1			5	1	24	31
April	(A. M.)						2	1		27	30
	(P. M.)							2		28	30
May	(A. M.)							3	1	27	31
	(P. M.)					1		3		27	31
June	(A. M.)									30	30
	(P. M.)									30	30
July	(A. M.)							1	4	26	31
	(P. M.)							4		27	31
August	(A. M.)									31	31
	(P. M.)									31	31
September	(A. M.)	5								31	31
	(P. M.)								2	23	30
October	(A. M.)	10								30	30
	(P. M.)	1						1		20	31
November	(A. M.)	11						1		20	31
	(P. M.)	12						1		18	30
December	(A. M.)	12								18	30
	(P. M.)	1						1	3	15	31
Total		85	3	4	6	3	3	35	18	573	790
Per cent of directed winds		54.1	1.9	2.6	3.8	1.9	1.9	22.3	11.5		100.0

Winds at San Pedro, from records at Point Firmin light-house—Continued.

		North and north- erly.	North- east.	East and east- erly.	South- east.	South and south- erly.	South- west.	West and west erly.	North- west.	Varia- ble.	Total.
1892.											
January	A. M.	10				1			1	19	31
	P. M.					2		10		19	31
February	A. M.		1		1	2	1			24	29
	P. M.					2				23	29
March	A. M.	3		1				2		25	31
	P. M.							4		27	31
April	A. M.	1						2	2	25	30
	P. M.							4	2	24	30
May	A. M.					1		3		27	31
	P. M.							4		27	31
June	A. M.					4				26	30
	P. M.							1		29	30
July	A. M.									31	31
	P. M.									31	31
August	A. M.	1				2		2		26	31
	P. M.					1				30	31
September	A. M.	6						3		21	30
	P. M.							9		21	30
October	A. M.	6	1					1	1	22	31
	P. M.	3						4		24	31
November	A. M.	11		2	2	1				15	30
	P. M.				1	1		12	2	14	30
December	A. M.	11	1	1	1	3				14	31
	P. M.				1	1		11		18	31
Total		52	3	4	6	20	1	76	8	562	733
Per cent of directed winds		30.6	1.8	2.4	3.5	11.7	0.6	44.7	4.7		100.0
1893.											
January	A. M.	2	1			2				26	31
	P. M.		1		1	2		2		26	31
February	A. M.	4				2				20	28
	P. M.						1	3	1	23	28
March	A. M.	2		1		2				25	31
	P. M.	3				1	1			25	31
April	A. M.	2		1		1		3		23	30
	P. M.	3						1		24	30
May	A. M.					1			1	29	31
	P. M.							4		26	31
June	A. M.					1			2	27	30
	P. M.									30	30
July	A. M.					1		4		26	31
	P. M.									31	31
August	A. M.	1							3	27	31
	P. M.							2		29	31
September	A. M.	2			1					27	30
	P. M.					1				30	30
October	A. M.	9				1				21	31
	P. M.				1					30	31
November	A. M.	2	1					1		26	30
	P. M.							2		28	30
December	A. M.	3	2	1	2					23	31
	P. M.			1						30	31
Total		33	5	4	5	14	2	28	7	632	730
Per cent of directed winds		33.7	5.1	4.1	5.1	14.3	2.0	28.6	7.1		100.0

DEEP-WATER HARBOR.

275

Winds at San Pedro, from records at Point Firmin light-house—Continued.

		North and north- erly.	North east.	East and east- erly.	South east.	South and south- erly.	South- west.	West and west- erly.	North- west.	Varia- ble.	Total.
1894.											
January	(A. M.	10		1				3	1	16	31
	(P. M.	1						8		22	31
February	(A. M.	3		1				2	1	21	28
	(P. M.							6	1	21	28
March	(A. M.	3		1		1		1	1	24	31
	(P. M.	1					1	4	1	24	31
April	(A. M.	4				1		2	2	21	30
	(P. M.							5		25	30
May	(A. M.	2	1		3			2	2	21	31
	(P. M.				1					30	31
June	(A. M.	2						1		27	30
	(P. M.							1		29	30
July	(A. M.									31	31
	(P. M.									31	31
August	(A. M.	2				3				26	31
	(P. M.							6		25	31
September	(A. M.							3		27	30
	(P. M.							2		28	30
October	(A. M.			2				1	2	28	31
	(P. M.									29	31
November	(A. M.			1				4		25	30
	(P. M.									30	30
December	(A. M.	10	1	1	1	1		3		14	31
	(P. M.		1	1						29	31
Total		38	3	8	5	6	1	54	11	604	730
Per cent of directed winds.		30.0	2.4	6.4	4.0	4.8	0.8	42.9	8.7	.....	100.0
1895.											
January	(A. M.	16			1	1				13	31
	(P. M.			1				2		28	31
February	(A. M.	9		1				3		15	28
	(P. M.							3		25	28
March	(A. M.	3		1			1			26	31
	(P. M.									31	31
April	(A. M.	3		1				4		22	30
	(P. M.							2		28	30
May	(A. M.				1	1		1	1	27	31
	(P. M.					1		1		29	31
June	(A. M.			2		1		3		24	30
	(P. M.	4				1		1		24	30
July	(A. M.					1		1		30	31
	(P. M.							1		30	31
August	(A. M.								1	30	31
	(P. M.							1		30	31
September	(A. M.			1						29	30
	(P. M.							9		21	30
October	(A. M.	3		2	1	1				24	31
	(P. M.				1			1		29	31
November	(A. M.	15					2			13	30
	(P. M.	1				1		1		27	30
December	(A. M.	25		2					2	2	31
	(P. M.			1			2	1	1	26	31
Total		79		12	4	7	5	35	5	583	730
Per cent of directed winds.		53.8		8.2	2.7	4.7	3.4	23.8	3.4	.....	100.0

Winds at San Pedro, from records at Point Firmin light-house—Continued.

		North and north- easterly.	North- east.	East and east- erly.	South- east.	South and south- easterly.	South- west.	West and west- erly.	North- west.	Varia- ble.	Total
1896.											
January	A. M.	3		1	1	2		4		20	31
	P. M.				3	3		15		10	31
February	A. M.	2	1							26	29
	P. M.							21		8	29
March	A. M.	13	1		1	1		3	1	11	31
	P. M.							3		28	31
April	A. M.	7	1		2			5		15	30
	P. M.	8						8		14	30
May	A. M.							3		28	31
	P. M.							2		29	31
June	A. M.	2		1		3	6	1		17	30
	P. M.									30	30
July	A. M.									31	31
	P. M.									31	31
August	A. M.					1				30	31
	P. M.									30	31
September	A. M.									30	30
	P. M.									30	30
October	A. M.	1			1		1			28	31
	P. M.						1			30	31
November	A. M.										
	P. M.										
December	A. M.										
	P. M.										
Total		36	3	2	8	10	8	65	1	477	618
Per cent of directed winds.		27.0	2.3	1.5	6.0	7.5	6.0	48.9	0.8	100.0	100.0

The wind records at the light-house extend backward over a long series of years. The foregoing are typical and a fair average of the entire series, and were correctly copied by me from the light-house keeper's journal. As regards the winds designated "variable," the light-house keeper stated that they veered from easterly in the morning to westerly in the afternoon, and constituted 80 per cent of the entire winds.

NOVEMBER, 1896.

O. G. MCWAIN.

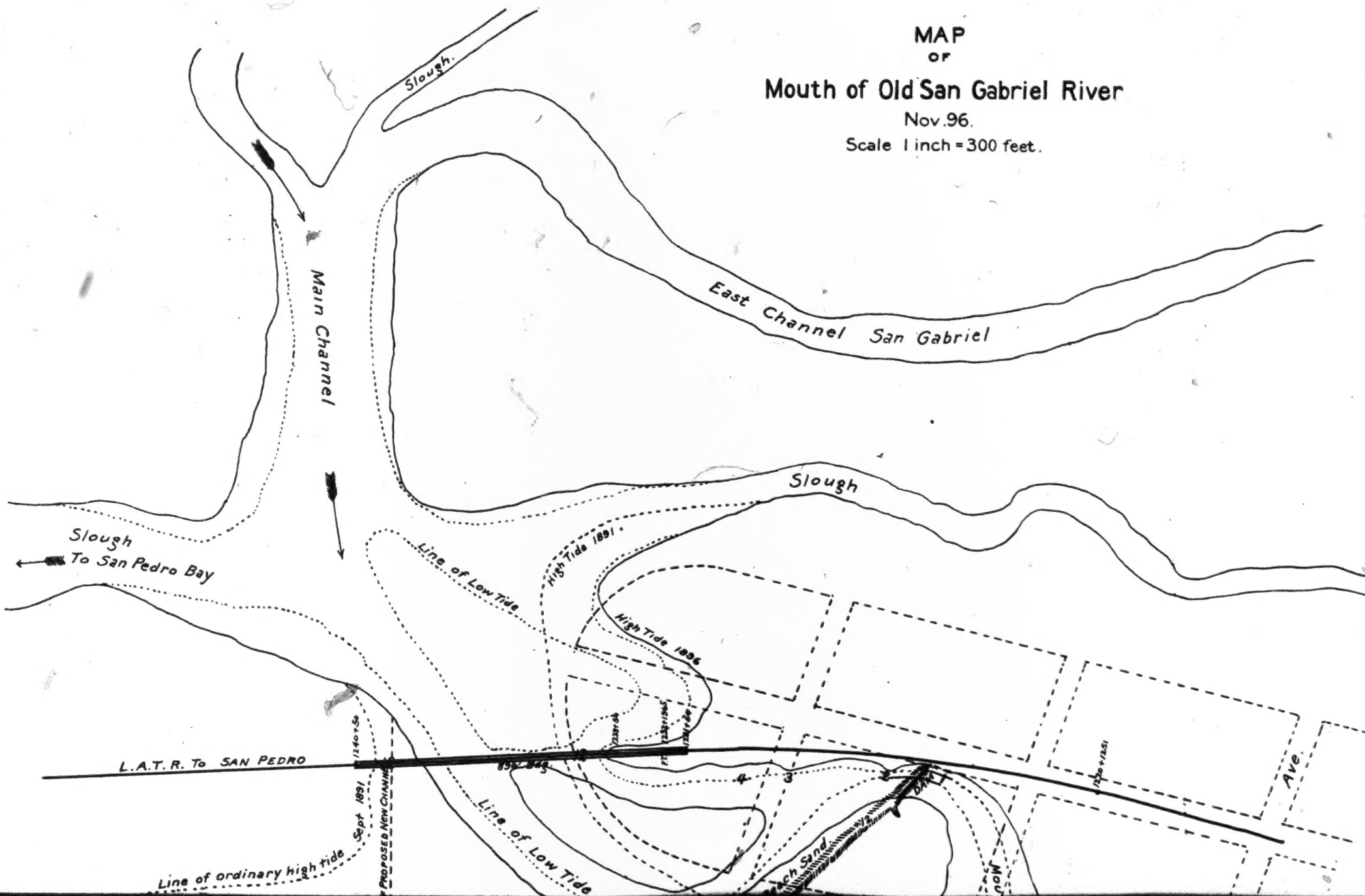
LOS ANGELES TERMINAL RAILWAY,
Los Angeles, Cal., December 26, 1896.

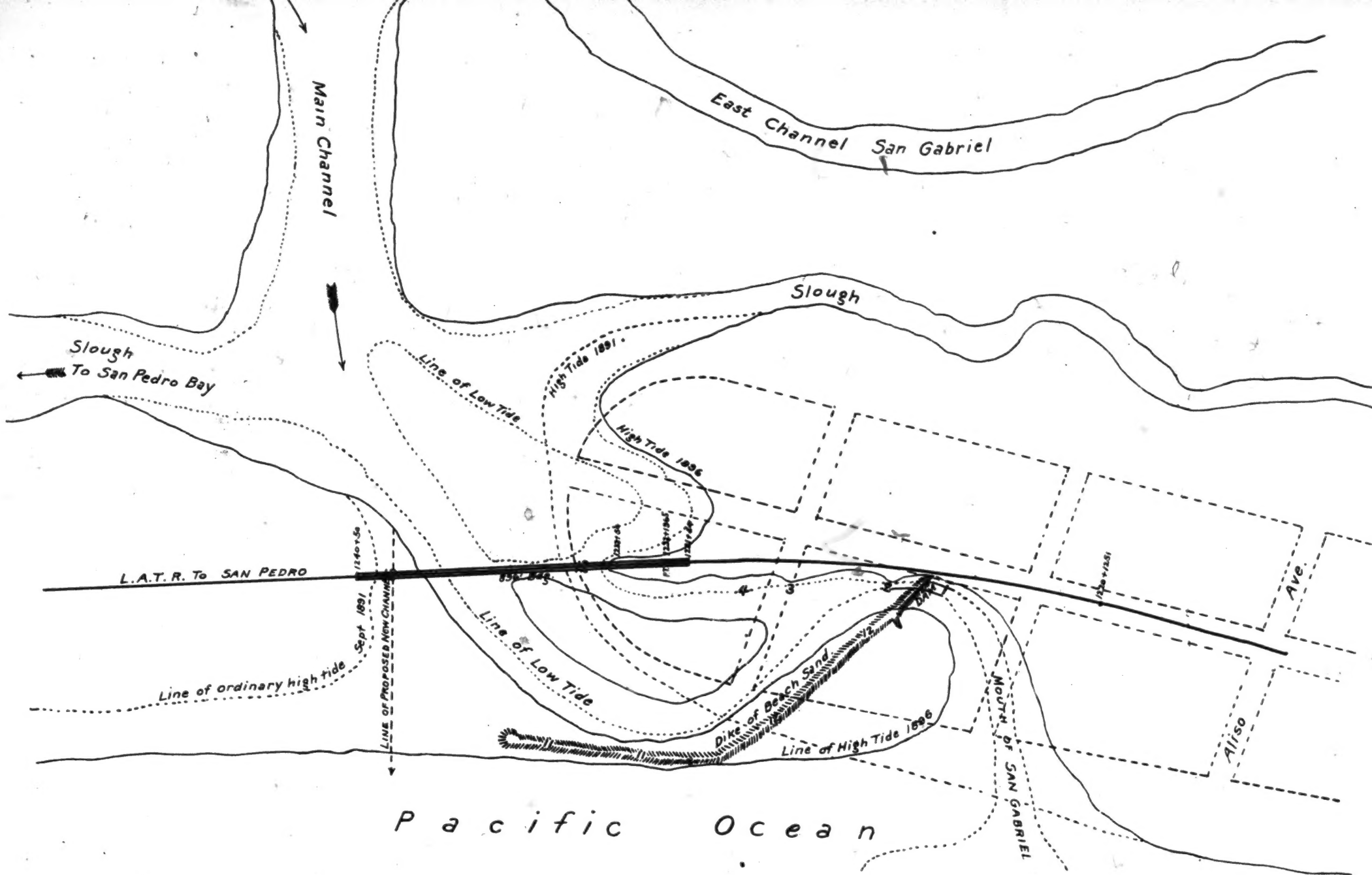
DEAR SIR: As requested in our conversation, I hand you herewith a blue print of the dam placed at the mouth of the old San Gabriel River. You will find dotted lines indicating the mark of the high tides in 1891. Irregular, broad white lines indicating the high-tide lines of October, 1896, when this dam was constructed. We had several high tides during that month that rapidly cut away our railroad line. We had attempted to protect it with sandbag jetties, constructing four at the points indicated by numbers in lead pencil. It finally cut so close to the track at jetty No. 1 that one night at low tide I closed the narrow channel, and while it did not hold back the high tide of next morning, by two nights I was able to build it to a sufficient height to prevent any further ebb and flow through the bridge. After completing the work, I went to San Francisco and conferred with Major Davis, who advised me I should have first obtained permission, but finally consented to my retaining the dam temporarily, provided we had no floods to bring debris or other deposit into the bay. We have not only watched the conditions at the mouth of the river, but also at our crossing of the river at what we call the County Farm, and also made frequent inspections of the waters at the head of the bay. The only waters now being emptied into the tide lands and through the old channel referred to are those of the Los Angeles River. The extent of this flow can be seen in this city near our station. There has been but little more water in the river than at the present time since the dam was constructed, and I do not believe any deposit has passed into San Pedro Bay proper from this source. I understand from the United States engineers that on the tide lands, inside of Terminal Island, there was a line at which the inflowing tides through the regular channel at San Pedro, and through the mouth of the old San Gabriel River, meet. My belief is that if there has been any silt, or deposit of any kind, carried into the tide lands it has been dropped into the deeper portions of the estuary before passing the shallow section where the tides meet. A very heavy downfall of rain, or a cloud-burst, at San Pedro

MAP
OF
Mouth of Old San Gabriel River

Nov. 96.

Scale 1 inch = 300 feet.





carried a good deal of deposit into the bay at that point and between there and Wilmington early this month.

I have not heard from Major Davis in reply to my letter, a copy of which I sent you, but I expect to go to San Francisco on Monday next, and will confer with him at that time. I have my force ready to cut the channel through and will soon do so, unless Major Davis wishes to retain it in its present condition for experimental purposes.

Yours, very truly,

S. B. HYNES,
General Manager.

Admiral J. G. WALKER,
Chairman of Deep-Water Harbor Board.

REPORT ON HARBORS.

[By Calvin Brown, C. E.]

PRESIDENT AND DIRECTORS OF THE PASADENA AND PACIFIC RAILWAY COMPANY.

GENTLEMEN: The subject of this paper is the consideration of the respective adaptations of the localities of the bays of Santa Monica and San Pedro on this coast for artificial harbors of refuge and commerce under the alternatives of a choice between the two as provided for by the establishment of a Government Commission for this purpose.

The writer may be allowed to state in support of his claim for competency of judgment in these matters that his experience in the construction of various harbor works, as well as in their hydrographic surveys and examinations, was in part derived from an active service of more than thirty years in the United States Navy, and from previous engagements in the Government service connected with the location and building of light-houses and beacons in exposed positions on the Atlantic Coast. Besides this practical experience the writer may claim familiarity by study and personal inspection of some of the important artificial harbors in Europe. To this knowledge may be added a personal correspondence on these general matters with several eminent engineers in Europe who have been extensively engaged upon such works.

Location of San Pedro proposed breakwater.—San Pedro Bay, or the portion thereof proposed for a harbor, lies in a comparatively narrow curvilinear indentation of the coast line, its southwesterly terminal being Point Firmin at the southeastern extremity of the promontory of San Pedro Hill, which, for this general coast line is a somewhat remarkable projection into the ocean. The bay lies entirely open to the sweep of the ocean, except southerly lies Santa Catalina Island, 21 miles distant from the promontory; consequently there is no shelter from the southeasterly or winter storms, the heaviest here experienced, and which beat upon its shore boundary, rendering the bay in its natural state quite untenable during their occurrence.

It is this condition that necessitates the erection of a breakwater if this anchorage is to be made safe.

At Point Firmin, and at a point marked on the blue-print copies of the Coast Survey chart as the shore end of the system of breakwaters, as proposed by the United States Army engineers, the water rapidly deepens, becoming shoaler to the north toward Deadmans Island, where the 3-fathom curve at low water is about a quarter of a mile distant southeasterly from that island. Within the area bounded by this curve and the westerly shore of the bay, the water gradually shoals to the low-water mark.

The location of the two systems proposed by the army engineers commences nearly or quite at the same point on the shore of the bay, about half a mile distant in a direct line easterly from the light-house at Point Firmin, the one proposed by the Board of officers in 1891 consisting of two distinct arms nearly or quite at right angles, separated at the angle by an open or entrance space of 1,500 feet wide to the harbor. The inshore line, or arm of this breakwater, extends in a southeasterly direction 2,400 feet and terminates in a depth of about 6 fathoms at low water, and forms the northwesterly end of the entrance opening to the harbor. The outer arm of this proposed breakwater commences at a point in the line of its inshore portion at the entrance distance of 1,500 feet, in a depth of 10 fathoms at low water, and extends northeasterly 5,600 feet, terminating in a depth of nearly 9 fathoms at low water.

The line of breakwater proposed by the army engineers in 1892 for San Pedro Bay is quite distinct from the one of 1891, both in location and the omission of an entrance opening therein.

It consists of a curvilinear trace terminating at the same point with the one above described, without other entrance to the harbor than at its outer or eastern end.

Location of Santa Monica proposed breakwater.—The bay of Santa Monica is formed by a deep curvilinear indentation of the coast line between Point Vincente on the east and Point Dume on the west, the distance between these points being about 28 miles, the line connecting them being the ocean boundary of the bay, thus inclosing an open and unobstructed area of deep water of many square miles, accessible from the ocean from the west, south, and southeast.

The apex of this bay, near the middle of its shore line, has been selected as the site of a proposed harbor, and the position of a breakwater therefor indicated upon the blue-print copies of the charts of the Government surveys and soundings at and extending easterly from Port Los Angeles. An examination of these soundings at the proposed harbor site shows a gradual and very uniform deepening of the water out to 50 and more fathoms at low tide.

The hydrographic curves at this locality run essentially parallel with the shore line, the 7-fathom curve lying at nearly $1\frac{1}{2}$ miles from the shore, while at about half a mile farther out the 10-fathom curve is reached.

The site of the proposed breakwater has been suggested upon the 7-fathom curve, the work to consist of a broken line in two connected arms, the longer, running upon the 7-fathom curve, to be 6,840 feet in length, and the other a short one of 1,550 feet, its inshore end terminating in a depth of $5\frac{1}{2}$ fathoms, both ends of the breakwater being free and marking two clear and wide entrances to the harbor from the ocean, in this feature reminding one of the notable detached breakwaters at Cherbourg and Marseilles, France, and many other works of the kind abroad.

The area covered by the proposed breakwater to the 4-fathom curve at low water will be about 635 acres, which will be available for sheltered anchorage for at least 200 average-sized vessels, including a liberal portion of the largest class, not to mention the number of smaller less draft craft which can find accommodation inside of the 4-fathom curve. This statement, demanding the consideration of the gales and storms which may compel shipping to seek a harbor of refuge, as well as the safety and convenience of that engaged in traffic and commerce and lying at the locality, requires a notice of the local conditions of efficiency which recommended the site for the establishment of a harbor both for refuge and commerce.

The construction of such a wharf as now exists at Santa Monica, and which has withstood the storms and action of the sea for several years without showing the least derangement of its alignment and structure, as was observed by the writer on a visit of a few days ago, is not only strong evidence of its resistance to the forces of the sea, but affords a conclusive intimation of its having been built after a careful and probably long-continued observation with a well-founded conviction therefrom of the general tranquillity of the bay, broken only by occasional storms, whose resistance, however, in order to the establishment of an ample and safe harbor at all times available, required the building of a breakwater.

Referring to the trace of the proposed breakwater, it will be seen that the harbor lies under the lee of the heaviest stormwinds (the southeasterly), whose effects become materially modified by the position of Point Vincente in their range, which thus reduces the fetch of the ocean swell to a few miles, and consequently theoretically lowers the height of the waves to about 4 feet from hollow to crest. This forms a low choppy sea at times at the beginning of a southeasterly gale. It is, however, to be noticed that these southeasterly gales have by no means a clear sweep over the harbor or its entrance, but as they approach thereto become essentially deadened and baffled in force by the effect of meeting the high and precipitous Calmenga Mountains, thus reducing their influence upon the sea. Such a condition of things must greatly reduce the theoretical deductions in regard to the height, and consequently force of the waves of the choppy sea above mentioned where their sweep is not interfered with by modifying causes. Very soon, however, after the commencement of a southeasterly gale the true or prevailing storm waves roll in from a southwesterly direction nearly at right angles to the direction of the stormwind, the latter wind then acting to reduce the height of these original storm waves. Such is the statement of the course and effect of these southeasterly gales as given to the writer by parties long familiar with the locality of Santa Monica Bay, both landmen and sailors, and by fishermen at San Pedro of a similar phenomenon.

It would therefore seem that if the proposed Santa Monica Harbor can by its breakwater be made secure from the effects of the worst waves of the locality, those from the southwesterly, there can be no question of its tranquillity or apprehension of its safety in any weather. On the west it is completely protected by the highlands bounding the bay; from the southwest the breakwater, of course, will be its protection. From observations made by the writer at the Santa Monica Wharf, he found the height of the same to be about 23 feet above low water or nearly 16 feet above high water, and from a statement made to him by the wharfinger, no sea had ever risen to its planking. Such a phenomenon occurring at a wharf built in 32 feet of water at low tide, and in so wide a bay, must be considered a demonstrable assurance of the economic as well as the utilitarian feasibility of building a breakwater in an

already improved locality whose seas rise no higher and with no greater force than a mere timber structure can withstand.

Another fact which seems a forcible intimation of the moderate height and force of the waves at the breakwater site is the presence there, as shown by borings, of soft mud, which has not been disturbed by the action of the swell. The presence of less mud within the harbor area near the shore, on the other hand, is readily accounted for by the action of tidal currents which sweep along the shore, carrying this soft and light substance away.

An inspection of the sounding changes which have occurred along the line of the wharf evidently proves the existence of such inshore currents, an indication that their effect will prevent shoaling of the harbor by deposits. All apprehensions of the existence of any dangerous undertow in the harbor must be dispelled by consideration of the fact that the open beach for years has been a popular resort for bathers, who, it may be remarked, are not apt to frequent and expose themselves to these perilous causes.

Comparison of the harbor sites of San Pedro and Santa Monica in regard to shipping accommodations.—Waiving the question of accessibility of the two sites by shipping, and assuming the locations of the several breakwaters as delineated upon the charts with their inclosing protected harbor areas, it appears, judging roughly from the charts, that the harbor at Santa Monica is the larger. In this conclusion, of course, no reference is made to the small inner channel at San Pedro or its mouth at Deadman's Island, which, in the present location of the two systems of proposed breakwaters at San Pedro, lies beyond their protection. The proposed harbor at Santa Monica will have two entrances, giving ingress thereto as may be chosen, according to circumstances of wind, weather, and purpose, and permitting the sweep of tides and currents in maintaining its depth.

At San Pedro and by the trace of breakwater proposed in 1891, two entrances are given to the harbor, one at its southwesterly extremity between the two arms of the breakwater, and the other at the northeasterly end of its longer arm. In the recommendation of 1892 the proposed breakwater is continuous without giving entrance except at its outer or eastern end to the harbor. These two systems clearly intimate a wide difference of opinion in the authorities who proposed them, and in the judgment of the writer both designs are unfavorable to the purposes to which they were applied. In the case of the entrance at the southwest there is left an opening for the full swell of the westerly and southwesterly ordinary and storm waves from that direction into the harbor, perhaps modified to some degree by the position of the westerly position of Santa Catalina Island, which would give a fetch of about 21 miles.

It obviously owes this deteriorating effect on the convenience of the harbor by its permitting an ocean swell of more than a quarter of a mile wide to sweep through it that prompted the recommendation in 1892 of a continuous line of breakwater with one entrance at its outer end to the harbor, which, although obviating the disadvantage of an interior swell, tended to promote the deposit of sand and mud within the harbor space, and necessitating dredging from time to time to preserve its depth.

From the records of the soundings and borings made at the two harbor sites it would appear that generally the holding ground is of about the same character in both, that of Santa Monica being proved perfectly reliable by the establishment there of numerous mooring buoys, whose position, according to the statement of the wharfinger, have never been disturbed by the swell, besides which is the fact of the numerous anchorages of shipping to the port of Los Angeles made at this place.

Among the conveniences of a harbor are the important conditions attending the entrance and egress of shipping, both operations requiring ample area for working the vessel. In approaching and entering, the conditions of space should be such as to afford open and direct course from any position from which it may be sought, and when once within reach of it and before coming to anchor therein, space for shortening sail or reducing speed should be allowed. So in departing from a harbor should space be afforded for getting under way and leaving in case tug boats are not always available, which sometimes might occur. In the provision of such facilities the larger and clearer the harbor space in its interior, as well as in its approaches and entrance, the better, and in regard to this condition and its comparison between the two proposed harbor sites, it is clear that to Santa Monica the superiority may be properly adjudged.

Shore facilities for the development of a harbor port for commercial and manufacturing purposes.—At San Pedro Bay a railroad has been built and a wharf partly erected, the former not now being used and the latter abandoned in its unfinished condition. These are the only signs of shore improvement now existing at this point, and for about a mile along the shore of the bay, from the starting place of the proposed breakwaters of the army engineers, the locality bounded westerly by the high San Pedro Hill, is entirely open. The south end of the town of San Pedro abuts upon

the northerly shore of the bay, the 1-fathom curve at low water lying at about a quarter of a mile therefrom. This curve, essentially parallel with the northerly shore, embraces a wide area of shoal water until it approaches opposite the end of the unfinished wharf from whence it comes close to the shore at the initial point of the two proposed breakwaters.

The 2-fathom curve lies at about an average of 700 feet farther out, running nearly parallel with the first mentioned, consequently if harbor improvements in wharves, etc., are here undertaken, they will have to be greatly lengthened to reach a proper depth of water, or else a large amount of dredging must be done to obtain this object. The only exception to this is at the site of the unfinished Southern Pacific Wharf, where the conditions are similar to those at Port Los Angeles, as to length of wharf required to reach the 5-fathom curve; that is, there is no reasonable economic wharf site at the proposed San Pedro outer harbor, except that occupied by the unfinished wharf of the Southern Pacific Company. As to building materials in the vicinity of San Pedro Bay, proper to harbor improvements, other than imported lumber, the writer can only say that he found none, which was not the case at Santa Monica, which is soon to be mentioned.

At Santa Monica Bay the position of the shore and the ample depth of water close to it admits of an economical development of commercial facilities in the building of wharves, repairing docks, etc., which can be extended along the water front as far as the protection of the breakwater reaches, and when it is considered that this outer work can be readily lengthened to meet the future demands of commerce and traffic, it is obvious that a long distance of shore may be available for extended mercantile business.

It is not however to be supposed that the present beach area is the only resource for the planting of commercial and manufacturing interests, although the width of this beach may be largely and cheaply increased by the use of the abundant filling materials furnished by the adjoining bluff—for in addition to the beach space is the easily available and contiguous territory of Santa Monica Canyon, which opens upon the beach and presents an ample and convenient building area already occupied by a considerable population for the locality and capable of maintaining greatly increased numbers. Beyond the present settlement of this canyon is found abundant materials of excellent gravel and inexhaustible quarries of hard rock available for the manufacture of concrete adapted to every variety of harbor building.

It seems almost unnecessary to say that the rich farming territory in connection with the city of Santa Monica and the bay is ample for the support of any number of people who may find occupation in the expansion of the business of its port. It might rationally seem that the large increase of population which such a desirable country must induce ought to be provided with a commensurate commercial port when one can be so readily provided for it, not to mention the necessities of the near proximity of the city of Los Angeles and its trade.

The importance of the port of Los Angeles, for several years recognized as a shipping port for both passengers and merchandise and as the nearest one to the large city of Los Angeles, has invited the attention of railroad builders, and two distinct lines have been carried to the locality, one terminating directly at the beach and the other extended farther on along the shore and over the entire length of the fine wharf which reaches 4,400 feet, or five-sixths of a mile, into the bay and in a depth of 32 feet at low water.

Even in the absence of a breakwater the largest ships lay safely alongside of this wharf, but it is obvious that protected from the ocean swell by a breakwater such a substantial wharf construction would not be required.

From these extensive improvements at Santa Monica Bay, undertaken mostly by the same corporation that undertook and abandoned similar works at the bay of San Pedro, it may rationally be inferred that competent causes founded on thorough study of that locality and a perception of the more favorable one finally adopted induced the successful change.

In conclusion, the writer would state that his observations of Santa Monica Bay were first made many years ago, when he became impressed by forcible conclusions of its admirable fitness for a refuge and commercial harbor, especially in the view of the scarcity of such harbors on this coast. Subsequently to this visit, an inquiry among experienced naval officers who had been engaged in the surveys of the locality corroborated his original impressions, while his visit of a few days ago, with the testimony then gathered from other navigators familiar with the place and the witness of the success of the noble wharf there, certified to a complete demonstration of the importance and feasibility of the establishment of a most accessible and commodious harbor in its waters.

Respectfully submitted.

CALVIN BROWN, C. E.

LOS ANGELES, December 19, 1896

LOS ANGELES, CAL., January 8, 1897.

DEAR SIR: Herewith please find four white prints No. 2389 as verbally requested by members of your Board, these corresponding to six blue prints sent you yesterday.

My office men write that it was very difficult to make good white prints from the rather old and worn tracing which they used and seem rather hurt that the prints were not better.

Inclosed please find a white print of the railroads in the vicinity of Los Angeles which may possibly be of service to you merely as a diagram of railroads. If you would like more I can furnish them.

I notice that this white print, which is numbered 4960, does not show clearly the Los Angeles Terminal Railroad going to Rattlesnake Island, an error in the original tracing which I had not heretofore noticed.

Yours, respectfully,

WILLIAM HOOD,

Chief Engineer Southern Pacific Company.

JOHN G. WALKER, Rear Admiral, U. S. N.,

Chairman Board for Locating a Deep-Water Harbor in Southern California.

MR. CHAIRMAN AND MEMBERS OF THE DEEP-WATER HARBOR BOARD: You are fully informed in regard to my connection personally with this subject, and know that I have been in a position for nearly three years where I must have necessarily become familiar with the views of Congress, and particularly of the committees before whom I have professionally discussed this subject at two sessions of Congress. The printed matter in your hands will confirm the above statement, and I need not refer again to this subject. I have alluded to it in order to show that I have some right to attempt to interpret the words of the act, having in mind not only the discussions in the Senate, but in the committees.

I desire to state briefly at the outset that from printed and other data, and from charts, experience, and testimony from experts it will appear or be fully proven:

(1) That the "deep-water harbor of commerce and of refuge," mentioned in the act constituting the Board, refers only to a harbor for deep-draft ocean merchant vessels, and has no reference to the local harbor at Wilmington, or to a harbor for naval or military purposes, or defensibility, although both of the alternate harbors named in the act may be equally adapted to these latter purposes.

(2) That the harbor to be provided is primarily for the ocean commerce of the entire country, and not especially for the section of the country in which the harbor is situated.

(3) That the question of the necessity for a harbor has already been settled in the affirmative by Congress, and there remain only the questions of location and structure; and further, that the action of this Board upon these questions is to be final.

(4) That the nautical and maritime conditions generally as to winds, waves, and currents, and their drift action, are more favorable at Port Los Angeles than at San Pedro, and that a breakwater at San Pedro would cost more to build and maintain than one at Port Los Angeles.

(5) That the holding ground for anchorage at Port Los Angeles is at least equal to that at San Pedro, and that wharves can be much more conveniently built and maintained there.

(6) That the land approaches by rail at Port Los Angeles are much superior and much more free from obstructions to entrance.

(7) That during three years past the great pier at Port Los Angeles has been in continual and generally safe use by large ships.

(8) That the successful operation of this pier for so long a time in an unprotected seaway establishes the superiority of this location, and that it will be generally acknowledged without argument that it would have been impossible to have operated one at San Pedro Point without a breakwater.

(9) That the location at Port Los Angeles has advantages over San Pedro in respect to the regular coastwise passenger and freight traffic, where time is of any importance.

(10) That even if a breakwater were built at San Pedro the advantages and present commercial facilities of Port Los Angeles would still command the ocean business.

(11) That the suitability of a detached breakwater under the conditions existing at Port Los Angeles is proven by experience in this country and other countries where a large number of such works have been built and maintained for commercial purposes.

The act requires a brief explanation to show how it came to be framed as it is, and to assist in interpreting it.

A hearing before the House committee had been given to the advocates of Wilmington Harbor; some little time afterwards a hearing was granted by the same committee to the advocates of Port Los Angeles; items for both harbors were placed in the bill; the advocates of Wilmington and San Pedro opposed the appropriation for Port Los Angeles; the House committee thereupon, with considerable feeling, threw both the Wilmington and Port Los Angeles items out of the bill. The bill then went

to the Senate committee, which replaced both items and thus reported the bill to the Senate, Port Los Angeles as against San Pedro being favored as a deep-water harbor by nine to four in the committee. The remaining history of this measure appears in the Senate discussion.

The Southern Pacific Company had agreed from the first—two years before, in the preceding Congress (see IV bound volume, pp. 14 and 15)—that the royalty on stone, if taken from its quarries, should not be greater than 12½ cents per cubic yard, and that the charge for transporting it should not be greater than one-half a cent per ton mile, and that any other railroad company should have, if they desired, the use of its approaches and tracks and the right to cross its tracks and right of way, and it agreed to build under the bluff, if it should be necessary for the business of the railroads, ten additional tracks. It also agreed to give any other company the right to use its great pier built at Port Los Angeles. The object of making these propositions was to remove objections that had been urged against Port Los Angeles as a deep-water harbor, and to make it freely and fairly used by any and all railroads. These are the reasons why certain requirements upon the Southern Pacific Company were incorporated in the act.

Referring to the words in the act, "deep-water harbor of commerce and of refuge," "deep water" was used to convey the idea that the harbor question was not in any way connected with the local harbor at Wilmington. Even if the deep-water harbor should be located at San Pedro, it was to be an outside harbor for ocean-going vessels.

The views of the chairman of the Senate Committee on Commerce, Senator Frye, no doubt express those of Congress on this point, and the following paragraphs are quoted from his speech, as appears on page 2 of the Senate discussion:

"I think the Senator from Missouri described the conditions at Los Angeles about right. But what has Los Angeles to do with this, anyway? Why, the Senator from Missouri and I have been in this fight about eight or ten years, I believe. We know all about it. We have got tired of it, too. I am very sorry to find him willing to have it run any further. I wish to get rid of it forever. I never want to hear of it again.

"Give Los Angeles an inner harbor of 18 feet depth of water and it will accommodate all the commerce of Los Angeles for the next fifty years. It is ample for it. If you put a breakwater outside of the interior harbor, you are throwing away \$392,000. The idea that the Los Angeles people are to instruct Congress where they shall put a harbor! For the commerce at Los Angeles? Nobody has ever talked about that. It is for the commerce of the world, and not only is it for the commerce of the world, but it is for a harbor of refuge—just as important as a harbor for commerce. The Atlantic Coast has harbors of refuge all along. We are building one now at Sandy Bay, on the New England coast, at a cost of \$5,000,000, and we have them every 40 or 50 miles, harbors in which tempest-tossed ships can run for refuge. They are just as important for protection to life and property as are protected harbors for commerce.

"The harbor that we are talking about here is not a little harbor for a town or a city. It is a harbor for the commerce of the world, a harbor for the ships of the world, and Los Angeles has no more interest in it and no more to say about it than the people in the city of Portland, Me."

The words "of commerce and of refuge" mean that the harbor to be provided is not for war purposes, either naval or military, except as a refuge when naval vessels wish to use it just as commercial vessels do for that purpose or for obtaining supplies. It was not intended to be a place for Government dry docks—that is, that feature is not a part of the question at issue, though both locations may be suitable for that purpose. Again, the question of defensibility in time of war is not involved, although both places may be equally defensible. The Board of United States Army Engineers in 1892 favored San Pedro, and General Miles, in 1894, Santa Monica, stating in a letter to Senator Frye: "In the immediate vicinity of Santa Monica there are very high and commanding bluffs, upon which land batteries of mortars and rifle guns could be placed, which would render the harbor easily defended." (See page 11 of Senator Frye's speech.) But in order that it may be further seen that the question of fortifications is not involved the following allusion to this feature in the Senate discussion is given:

"Mr. VEST. That struck me, because I have always believed that that is the defect in the system of putting all the rivers and harbors exclusively under the Engineer Corps. I asked him specially that question, and he said: 'We are not riparian engineers; it is for the Coast and Geodetic Survey to examine the floor of the ocean and make soundings; but we are fortification engineers;' and if you will take the report upon San Pedro you will find one-third of it, speaking with all due limitation, is as to the point of defending San Pedro in case of war, proving that they were fortification engineers and looked upon the subject from that view of the case." (See p. 5542 of the Senate discussion.)

The following is also extracted from Senator Vest's speech:

"These engineers went to San Pedro and Santa Monica. Their first idea was how these places were to be defended in case of a naval war, and when they look at any improvement upon the seacoast that is naturally their first idea, because they are West Pointers, trained in the art of destroying men and of defending localities." (See p. 5593 of Senate discussion).

The following paragraph on the same subject is from Senator Frye's speech:

"A Board of Army Engineers made its report, and I declare that never in a single instance did the first Board of Army Engineers or the second Board of Army Engineers, either one of them, condemn Santa Monica as a harbor, and no condemnation of it can be found in their report. They simply expressed a preference for San Pedro and gave their reasons, and the most prominent reason was that it was better adapted to fortification than was Santa Monica. That was the principal reason, and, as the Senator from Missouri has said, occupied more space in their report than did anything else." (See p. 3.)

These extracts are simply illustrative of much that was said in the discussions of this subject.

The alternative outer harbors to be formed by the breakwater for which the appropriation is made is the limit of the question at issue. This is indicated clearly by the provisions of the act relative to Wilmington Harbor. The item for this harbor reads as follows:

"Improving Wilmington Harbor, California, in accordance with the project submitted February seventh, eighteen hundred and ninety-five, fifty thousand dollars: *Provided*, That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three hundred and forty-two thousand dollars, exclusive of the amount herein appropriated [fifty thousand dollars]; but no such contracts shall be entered into until the Board provided for in this act to determine the location of a deep-water harbor for commerce and of refuge, as between Port Los Angeles, in Santa Monica Bay, and San Pedro, in the State of California, has made its report to the Secretary of War, and not at all if said report shall be in favor of San Pedro as the location of said harbor." (See p. 14 of the Act, being X of bound volume.)

That is, Congress was unwilling to do any more work at Wilmington on the inner harbor if the outer harbor should be built at San Pedro; and facilities there for local commerce requiring deeper water than the present works have provided, 13½ feet at low water must be established in the outer harbor; in other words, they must abandon the inner harbor and move out. From these various proofs submitted I again assert, with your consent and forbearance, that, in my opinion, the inner harbor at Wilmington has nothing whatever to do with the questions submitted to the Board, and I may say further, that unless the Board should locate the deep-water harbor at Port Los Angeles, Congress expressed itself as unwilling to consider the local coast-wise commerce doing business at Wilmington of enough importance to justify making the channel provided for in the Wilmington Harbor item, Congress considering that, improved to the present extent, it "will answer the purpose for the ordinary trade of the Pacific Coast."

I am desired by the chairman of the Senate Committee on Commerce to state these interpretations of the act to the Board, otherwise I might well hesitate to do it, even though I knew (as I do), from intimate knowledge of the discussions in the committee and the Senate, what were the views of the majority of the committee and of other Senators and Representatives. I will, therefore, go still further in clearing up this point, and say that the views of the chairman of the Senate committee, which I consider are the views of his colleagues as well and expresses the purpose of Congress in making this appropriation, are seen following: The committee was considering a great commercial harbor—one that would accommodate the great ocean-going steamers doing the carrying trade of the Orient. It was believed, by the chairman at least, that in the future our commerce in the Pacific would be at least equal to that on the Atlantic, particularly when the Nicaragua Canal should be constructed by our Government, bringing us nearer to the 500,000,000 of people of the East than Great Britain is; also that Wilmington would do very well for the local commerce and for the small coasting vessels loaded with lumber and other products of the Pacific Coast, but would prove to be entirely inadequate for a deep-sea commercial harbor; and referring once more to the question of fortifications, the army engineers placed great stress upon the defensive qualities of a harbor, but the chairman of the committee believes that in constructing a harbor or in the improvement of one already partially constructed Congress has never given any consideration to the question of its defense. The state of the case being as I have outlined it, and the evident purpose of Congress being to expend for harbor improvements, first, for a deep-water harbor for the whole country, \$2,900,000, if located at Port Los Angeles, and for a local harbor at Wilmington for the benefit of the section of the country tributary to Los Angeles, \$392,000,

a total of \$3,292,000, the question appears to resolve itself, so far as the interests of this location and the whole country are concerned, and I fail to see what possible motive the real commercial interests at Wilmington can have in opposing the location of the deep-water harbor at Santa Monica, for, if it is located at San Pedro, the inner harbor at Wilmington, with its shallow depth and crooked entrance, is deprived of the \$392,000 which Congress would expend upon it if the deep-water harbor had been located at Port Los Angeles; in other words, the interests at Wilmington, local, coastwise, or railroad, must, for deeper and larger channels, and generally larger facilities, move out into the outer harbor, which in the course of this discussion will be shown to be unsuitable for them and inaccessible for the railroad located on the east side of the river and approachable only at great inconvenience by the railroad company now on the west side, and which railroad company has not now and never will have any desire to utilize the space back of a breakwater, as proposed at Point San Pedro. It is safe to predict, judging from the temper of Congress as shown this last session, both in the Senate and the House (I use the word "temper" advisedly), that the \$2,900,000 provided for an outer harbor at San Pedro, if the Board should locate it there, is all that this part of California will obtain from the Government for a quarter of a century to come: but that if the deep-water harbor for the commerce of the whole country should be located at Santa Monica, then the local Wilmington commerce will have not only the nearly \$400,000 now provided for that harbor, but may reasonably expect further appropriations in future, if it can be shown at any time that the local commerce there requires further facilities.

The subject of a deep-water harbor, thus simplified and divested of local commercial features and military questions, naturally divides itself into maritime features and land features, the former into sea approaches and commercial facilities and the latter into land approaches and railroad facilities.

I may be permitted to express further the satisfaction that all interested must feel in being able to be present now, after years of controversy, the important conditions of this question to a Board appointed by Congress really as referees or a court of last resort, the action of which is absolutely final, not to be reviewed, criticised, annulled, approved, or disapproved by any legislative or executive department of the Federal Government. This feature of the case gives to the Board unusual and extraordinary powers, and it is exceedingly important for all commercial interests affected by the decision that Congress decided to leave the question at last to an absolutely impartial Board.

I will now enter upon the technical discussion of the subject. I shall attempt to follow a logical order, discussing principally the maritime features, leaving most of the land features and many details of even the maritime conditions to my associate, Mr. William Hood, chief engineer of the Southern Pacific Company, whose familiarity with and knowledge of the details is far in advance of my own. I shall for convenience and to save time and description make references to a bound volume containing ten printed documents, a set of bound exhibits, a large number of unbound exhibits in the shape of charts, plans, etc., and to a bound volume of the Senate discussion upon this subject.

(1) Santa Monica Bay is a deep indentation of the coast line and is at Port Los Angeles, where the Southern Pacific has built its great pier, 12 miles inland from a line drawn between the headlands of Point Vincente and Point Dume. San Pedro is at Point Firmin, a headland itself, and the breakwater proposed there must necessarily be in the open ocean beyond this point. These general features are plainly shown by the large map and the two Coast Survey maps, which have been joined together and which are exhibited to the Board. The larger map, about 13 feet in length and 5 feet in width, is an enlargement by pantograph from the Coast Survey map, and is therefore, as far as general outlines are concerned, sufficiently correct for the purposes of a general exhibition of the main features of the coast. The topography upon it, where roughly shaded, is also sufficiently correct to give an idea of the altitudes back of the coast line.

(2) The sea slope at Santa Monica, from the shore to 300 fathoms, a distance of about 12 miles, is quite even and uniform and nowhere abrupt; the sea slope at San Pedro is very steep from a point 2 miles from the proposed breakwater. The blueprint profile exhibited of the sea bottom at both places is drawn from the assumed position of the breakwater at each harbor and in a direction seaward of south 35° west, from which the heavy ocean swells approach both works. The horizontal broken lines represent depths by 50 fathoms; the vertical broken lines distances from the breakwaters by miles. It will be seen that from a point 3 miles distant to 4 miles distant from the breakwater at San Pedro the sea bottom drops from about 50 fathoms to over 300 fathoms, while the Santa Monica slope at a distance of 10 miles from the breakwater is still but a little over 200 fathoms below the surface of the water.

From the Santa Monica profile, and from the even lateral slope in the sea bottom as well, it will be apparent that the waves, after passing inland from Point Dume,

materially feel the effects of a shoaling sea bottom, and are retarded and lessened very considerably before reaching the vicinity of the proposed breakwater.

Catalina Island has been stated to protect in a measure the proposed harbor at San Pedro. The following magnetic directions will show that this is incorrect: The ordinary ocean swell, as given in No. II, bound volume, page 7, being the report of the Board of 1892, is south 45° west; the heavy ocean swell is about south 35° west; the heaviest ocean swell about south 30° west. The extreme westerly end of Catalina Island is south 34° west from San Pedro, which shows that the ordinary and heavy ocean swell is not interrupted by any portion of Catalina Island. The eastern end of Catalina Island is south 14° east from the San Pedro breakwater, and the winter storms come from a direction south 54° east, showing that this island does not protect the breakwater from these storms.

During the discussion in the Senate committee last session a discussion was also going on in the House Committee on Interstate and Foreign Commerce upon the report of the Nicaragua Canal Board, and an answer of Colonel Ludlow to a question put to him by a member of the committee is particularly applicable to the subject of wave modification by sea slopes. The subject under consideration was the proposed harbor at Brito, at the Pacific terminus of the canal, and the conditions as described by Colonel Ludlow, both topographic and hydrographic, are quite similar to those at San Pedro. The following is from his remarks:

"The water deepens there very rapidly: you are in 10 fathoms very soon, and in a mile and a half you have gained 26 or 27 fathoms, and in another mile you have gained another 10 fathoms. On the Atlantic Coast our depth runs about a fathom to the mile, and in this case within $2\frac{1}{2}$ miles we have 36 fathoms or some such matter on the Pacific. That is the reason that these fearful swells come in, as there is no shallow water to diminish the roll."

I was interested to make a comparison between the sea slopes of Brito and San Pedro from the charts. This comparison is as follows:

Comparative sea slopes.

Distance from breakwater.	Brito. San Pedro.	
	Fathoms.	Fathoms.
$\frac{1}{2}$ mile	11	11
$1\frac{1}{2}$ miles	20	20
3 miles	30	55
4 miles	33	300

From this it will be seen that the steepness of the slope at San Pedro is much greater than at Brito, and consequently, for the reasons given by Colonel Ludlow, the swells coming in to the breakwater would be much more "fearful."

As an additional confirmative opinion on this subject, I give following an extract from a communication by Commander H. C. Taylor, United States Navy, who has had, from his own statement, considerable experience in Santa Monica Bay while conducting the surveys carried on there, and who has laid at anchor at all seasons of the year at and near Santa Monica on the Government vessel which he commanded:

"The bay of Santa Monica is, in its combination of natural features, unique on the Pacific Coast. Here the depth of water increases from the beach outward, with an easy and gradual slope for several miles. Here a breakwater can be established to inclose and shelter a capacious harbor without being in water so deep as to make its construction impracticable or even difficult.

"The marked feature of the Pacific Coast is the steep slope of the bottom as we move from shore to seaward. This rule has few exceptions, and it results that along the entire coast a breakwater to inclose a sufficient sheltered area would have to be placed in such deep water as to be impossible of construction.

"Among the few exceptions is the bay of Santa Monica. It is a remarkable coincidence that the coast line, in a deep curve, here approaches nearer than at any other point to Los Angeles and to the fertile region of which it is the depot.

"The bay of Santa Monica has along most of its shore line this quality of gradual deepening of the water, the bay of itself being occupied by a submarine plateau unique upon the Pacific Coast.

"The swell which rolls in at this anchorage is much modified, even in the worst weather, by the effect of the large islands to seaward, and by the deep recessed position of this portion of the bay shore.

"I have never seen any weather in which a vessel could not ride at her anchors there in safety, and but few occasions when unloading at a wharf was impracticable." (See pp. 109, 110, II bound volume.)

The above was written some years ago, but the favorable opinion of Captain Taylor has not been changed, as will appear by the following extract from the speech of Senator Frye in the Senate discussion of this subject:

"Then he [Taylor] goes on to argue the necessity of a great harbor and the absolute necessity and practicability of locating it at Santa Monica. Captain Taylor is now the president of the Naval War College at Newport. At the request of the committee I wrote to Captain Taylor informing him that there was to be a hearing before the committee on such a day, and asking him if he would not be present and give his testimony. He received the letter too late for the hearing. He wrote me that he would come at any time the committee desired, but that he must be authorized to do so by the Secretary of the Navy. A telegram was sent to him the next day, in order to save him from coming if possible, to know whether or not he had changed his mind any about Santa Monica since he made the report, and he said in a telegram: 'Nautical advantages excellent. Natural location great port. My opinion strong.'"

An examination of the large map exhibited will show that the heavy ocean swell strikes the Santa Monica breakwater at a much better angle than at San Pedro. At the latter place if the breakwater should be designed according to the plan of the Board of 1892 there will be only one point where the direction of the heavy swell will be normal to the dike, elsewhere it will strike it at a sharper and sharper angle. It is well known by those familiar with the construction and maintenance of these works that the greatest destruction to jetties and breakwaters is caused by what are termed "racers," which rush with great rapidity along the line of the work, often ripping up and scattering very heavy blocks of stone or concrete.

(3) In reference to the topographical features the country back of Santa Monica Canyon is very high. This has the effect of deadening the winds for some distance seaward as they approach the shore; this highland also protects the harbor from violent northerly and northwesterly winds. The headland on the southeast of Santa Monica Bay furnishes also some protection against the southeast stormwinds. At San Pedro these three conditions do not exist, except that San Pedro Hill protects against the northwest wind, but the country back of it is not of sufficient altitude or in sufficient mass to cause a deadening of the winds from the ocean and the winter winds would blow directly into the harbor even if a breakwater were built there and particularly into the entrance of Wilmington Channel. These topographical features are clearly shown by the large map exhibited, the mountain heights back of Santa Monica are nearly 2,000 feet above the level of the sea on the northwest. That I am not alone in the opinion as to the effect of the highlands lying back of harbors in deadening the winds offshore, I will quote again from Commander Taylor from the same communication as before:

"But certain portions of the shore line of the bay have other advantages in addition. The town of Santa Monica is situated at a point on the shore near a neighboring range of mountains, against or toward which blow the only winds of violence. The force of the wind blowing against a great barrier is deadened for some distance to windward of such barrier, and this probably accounts for the well-known fact that the winds at Santa Monica do not blow with violence." (See p. 110, II bound volume.)

Mr. Hawgood criticises the plan of the Board of 1892 in reference to wind exposure at San Pedro as follows:

"The proposed breakwater is deficient in that it would afford no protection whatever to the mouth of the inner harbor against the winter storms from the southeast. The entrance would continue to be exposed to their full force as at present." See p. 6, III bound volume.)

Senator Frye, who, as you are aware, has had, for a layman, large experience in the study of maritime subjects, and while he may not be a navigator is sufficiently familiar with navigation and its conditions to enable him to give a reliable opinion on many subjects of this nature. The following paragraph is from his speech on this subject:

"I wish to call your attention to one point more in this connection. You see that arrow is southwest [indicating]; as a matter of course, southeast would be this way [indicating]. Will any Senator tell me how that breakwater protects the proposed San Pedro Harbor from a southeast gale? Not the slightest under the sun. The southeast gale comes right square into the mouth of it. As a matter of course, if the breakwater be extended away around, it could not keep the wind out. It has full sweep and full sway. It is admitted by everybody in this controversy that it is the southeast wind that the mariners are afraid of on the Pacific Coast. Yet the harbor of San Pedro, fix it up the best way you can, is right out with open arms, apparently anxious to receive into its bosom the terrific southeast gales, while the other one is absolutely protected from them." (See p. 2, Senate discussion.)

There are submitted statements made by shipmasters, who are familiar with Santa Monica Bay, and with Port Los Angeles particularly, and in these statements will be found many corroborative evidences of favorable wind and wave conditions of Port

Los Angeles. These are marked Exhibit N. In the letter of George Hansell, master of the British bark *Fernbank*, April 11, 1896, is a very forcibly and nautically expressed statement in regard to the wind and wave conditions at Port Los Angeles. "Of course, it is well understood that a lee shore is a bad anchorage, but the contrary is accounted for [at Port Los Angeles] by the fact that the mountains of the Coast Range prevent the winds from blowing home, and the gradually sloping sea bottom of the bay retards the swell so that it does not attain the size and force that it would under ordinary circumstances."

C. H. Anderson, master American steamer *Progreso*, January 3, 1896, writes as follows:

"On my way down to Port Los Angeles I encountered very heavy weather all along the coast, particularly off Port Concepcion. After rounding Point Dume, as I approached Port Los Angeles, I was surprised to observe how the waves gradually moderated, and after arriving at the anchorage to find that the sea was comparatively smooth. Since I have been lying at Port Los Angeles, a heavy southwest gale has been prevailing all along the coast, the bar at San Francisco breaking, yet no bad effect has been felt here, either from the sea or wind."

The conditions described are further confirmed by George Dettmers, master steamer *Alcatraz*, December 28, 1895.

"In conclusion I would say that during the many voyages I have made to this port, although experiencing some very heavy weather and seas in Santa Barbara Channel, on approaching Port Los Angeles I have found the swells diminish and cease altogether when getting within a couple of miles of the harbor. I have laid alongside the wharf during all kinds of weather, and have not seen the time when I could not load or discharge my cargo with safety and dispatch."

This is the testimony of a vessel master who has been engaged in the seafaring business on the Pacific Coast since 1873, and claims to be thoroughly acquainted with all and every port on the coast from Puget Sound to Lower California. It may be pertinent to state still further that he writes that at one time he was in favor of San Pedro as a deep-water harbor, and even signed a petition in favor of that port, but this was before he had been at Port Los Angeles and was not aware of the possibilities it possessed. The opinion he has given in regard to the nautical conditions there was after having made some 28 trips to the wharf, which have entirely changed his opinion as to the merits of the two places.

As no doubt the reports of previous Boards will be carefully examined by the present Board, I wish in this connection to call attention to a rather remarkable statement made on page 19 of Ex. Doc. No. 41, being II of bound volume, in which appears the following:

"The San Pedro Hill, 1,493 feet high, which forms the west side of the bay, furnishes a more protected shelter from wind and sea than could be afforded by any artificial structure in Santa Monica Bay." When the height of the country north and northwest of Santa Monica Bay is recollected, the question may be asked, what this expression means, for certainly if the isolated San Pedro Hill protects that bay, why should not a range of mountains nearly 2,000 feet high equally protect Santa Monica Bay?

(4) The drift of sand along the shore by the ocean currents would shoal seriously a protected harbor formed by a dike connected with the shore at San Pedro Point, and should an opening to avoid this disaster be left in the dike it would let in the great ocean swell to the damage of shipping. At Port Los Angeles the dike will be parallel to these shore currents and would cause no deposit, nor would wharves built on piles as has been proven by experience at the great wharf built three years ago. (See profile, Exhibit No. 3.) As his opinion, already expressed in the discussion of this subject before the Senate, has been combatted, it is necessary to go into considerable detail in order to state the conditions and to draw conclusions from the works constructed elsewhere. I refer the Board to the bound Exhibit I, being a memorandum in relation to Pacific Coast currents taken largely from the "West Coast South America, No. 89, published in 1889," page 114. The existence of a northwest or northerly current is noted at various points from near the southern limits of South America to British America: "This current aided by the wind carries enormous masses of sand along the coast of Aracania, and is found as far north as Valparaiso. This sand is deposited at all capes projecting there westward and in all bays and harbors projecting there eastward." This current is called the Humboldt current or current of Peru; its velocity varies greatly, but is generally greater near the coast. The current has also been found in the Gulf of Panama, setting to the northward with a velocity of from 24 to 26 miles per day, extending offshore about 60 miles.

Professor Davidson, recently of the United States Coast and Geodetic Survey, is the discover of the Davidson inshore eddy current, existing along the western coast of the United States.

In addition to these littoral ocean currents, which of course are at times changed

and even reversed by opposing winds, there is usually along the coast of California a strong flood-tide current occurring twice each day; it is at times sufficiently strong to carry the sand along with it; its direction is generally northerly, striking the coast often at an angle. The depositing action of these northern currents is seen at many points; at San Diego an immediate effect of building a dike into this current is described in the report of the engineer, Mr. F. C. Turner, dated June 30, 1895:

"The beach has built out farther [that is, since the report of the previous year] at the root of the jetty, so that the low-water mark is nearly to the end of the approach curve. The shore accretion extends eastward about 200 feet.

"As was expected, a channel formed during the winter across [around] the end of the jetty. The flood tide is predominant so far, swinging around the end from the east and from along the shore as at San Pedro.

"The strongest current [flood-tide current] I have yet noted is about 2 feet per second across the jetty." (See pp. 3276 and 3277, part 5 of the Report of the Chief of Engineers for 1895.)

The facts in regard to the northerly current, above referred to, are stated in a commercial paper read before the American Society of Civil Engineers, March 15, 1893, by Maj. Thomas W. Symons, United States Engineer, a member of the society:

"*Currents.*—The main drift of the waters off the coast is from the northwestward. This is the flow of the great Japan stream after striking the northwest coast. The great ocean current produces a reflex eddy current to the northward. This northerly inshore eddy current is established by much cumulative evidence. It is stated by Professor Davidson that nine out of ten of the buoys that go adrift off the Columbia River go ashore to the north at distances varying from 20 to 100 miles. A remarkable instance of this drifting to the north is that of a large nun buoy, which went adrift from the Columbia River bar in January, 1889, and traveled in 167 days 1,540 miles up into the waters of Alaska."

The movement of sand is graphically described. On page 158 he states:

"The Coast Range of mountains, the summits of which are at an average distance of about 20 miles from the shore, are composed mostly of sandstone, of which a great portion is soft and easily eroded. The sand resulting from these two causes has accumulated along the shore in vast quantities to be the plaything of the winds, waves, and currents. Besides visible sand there is that forming the foreshore, the shoals and bars, and held in suspension in the ever-moving waters.

"To control properly and efficiently this sand is particularly and primarily the object of most of the improvements on the coast.

"A careful study therefore of the movement of these sands in air and water is necessary in order to hit upon the best plan for improvement in any particular locality."

The facts as above stated by Major Symons are corroborated by Col. George H. Mendell. In his discussion of the paper he states:

"The sand is mobile and may be said to be always in motion by wind, wave, or current, and is peculiarly exposed to the action of drifting currents."

On the northern coast of the Mediterranean, both in Italy and in France, a littoral current moving eastward has long been known and has within the last few years been utilized to protect the toe of the embankment of the railroad between Nice and Genoa particularly. Previous to the application of this plan it was attempted, unsuccessfully, to hold the shore by means of retaining walls and revetments, but now the building of dikes or groins into the sea has arrested the moving sands carried along by this littoral current and has effectually protected the shore.

The conditions on the Pacific Coast of the United States and in the Gulf of Mexico are quite similar. The Japan current on the Pacific, coming from the northwest, produces the inshore eddy current of Professor Davidson, moving in an opposite direction along the coast. The Gulf Stream in the Gulf of Mexico, moving toward the Florida Straits, produces an inshore or eddy current, moving westward along the delta of the Mississippi and as far west as Galveston or Brazos. On the western coast of the Gulf, in the Bay of Campeche, and as far north as Tampico, there is along the coast a prevailing current, which may be called the Gulf Stream current, flowing in around the promontory of Yucatan and hugging the shore. The effect of building works into these currents in the Gulf of Mexico is identical with the effect on the Pacific Coast already described; that is, they deposit the moving sands on the side of the works from which the current comes. At the South Pass jetties the sands were banked up on the east or current side of the works for a distance of about 4,000 feet inshore; at Tampico, about 2,000 feet; at the Brazos jetties this effect was also seen. At Vera Cruz, by the closing of the channel through which these currents pass the city of Vera Cruz, a deposit was formed in the harbor.

Even on the Great Lakes under the action of prevailing winds there is a littoral current produced which leads to the deposit of sand if dikes or groins are built out into it. It is the common practice at Chicago, which lies within the influence of

this current and wave action, to make a shore by building short dikes or jetties out into the lake.

The general principle, of which the above illustrations are given, is stated by Vernon Harcourt in his work on Harbors and Docks, on pages 59 and 61, where he states that on most shores the shingle (small gravel) and sand are constantly progressing along the coast. He states that on a straight coast line there is little evidence of this motion, but that as soon as an obstacle is presented to this alongshore progression the sand heaps up against the side of the obstacle facing the direction from which it comes, and that this action is frequently availed of to protect shores against erosion by the projection of groins of timber, stone, or concrete from the shore, arresting the travel of this material and forming an artificial foreshore in front of the coast. After giving several illustrations along the coast of Great Britain of this moving material he states that the sand washed from the coast and also produced by the destruction of the shingle, is conveyed much further, and, owing to its lightness, is readily affected by the slightest influence of wind, wave, or tidal current. In the English Channel it is carried by the more powerful north-easterly current through the Dover Straits into the North Sea, where the current expanding under the shelter of the French and Belgian coast deposits its sands against any obstacle in its course, and that the jetty harbors of the North Sea, when projected from the shore, act like groins and arrest the traveling sand, which causes a progression of the foreshore. The sand-bearing current finds also sheltered places in the estuaries of the Scheldt and the Maas where it leaves its sediment. The fact as to the latter place I can corroborate from personal examination.

I am confirmed in my opinion, both from my own experience and from study of the subject that if, for instance, the straight jetty at Tampico, 7,000 feet in length and normal to the shore line, had been curved in the same manner as was proposed by the Board of 1892 for the breakwater at San Pedro the entire area inclosed would in a short time have been entirely filled to the surface of the water by the accumulated sands moving in the ordinary littoral current, which I believe to be no stronger and to carry no more sand than the current along this part of the coast of California. I believe also that should a solid pier be built out any distance in Santa Monica Bay there would be formed a deposit on the eastern side of it and a progression outward of the foreshore. This is the reason why an open or pile is the proper construction to extend into this bay. I had made some examinations in 1894 of the effect of this coast current upon the bottom of the bay at the pier of the Southern Pacific Company and I found that there had been a slight deepening between the bents of piles, probably equaling in area the obstruction of the bents themselves and later soundings show similar conditions; for this reason I think it can be safely predicted that open pile piers allow sufficiently free movement to the coast current to prevent any deposit.

The description of these conditions given in a memorandum by Professor Davidson in a letter to the Board of 1892, bound Volume II, page 105 of this, is applicable at this point. The two following quotations refer to San Pedro Bay:

"The bay is the northwestern limit of a very extensive plateau of comparatively shoal water along the seaboard from Point Firmin to about Newport, and the whole country behind the shore is sandy and so low that in winter it is flooded for miles inland by the rains and the overflowing of the low banks of the numerous streams, frequently changing their courses. The detritus from these streams is moved seaward, and principally to the westward over this plateau, and helping to extend it, by the action of the inshore eddy current."

"With the chart of the Coast Survey before us, we have drawn rough lines of the suggested breakwater to cover the exigencies of vessels entering the harbor from the west, or around the exterior extremity of the breakwater, and to give free movement to the inshore eddy current carrying its material to the westward."

The current in Santa Monica Bay was, he says, sufficiently strong to cause the surveying vessel to ride to the current with a strong westerly breeze blowing.

The existence of a northerly current at the entrance to Wilmington Harbor is plainly indicated by the hydrographic chart accompanying Senate Ex. Doc. No. 61, Fifty-third Congress, third session, being the report of Colonel Benyaurd, dated February 7, 1895. He states on page 3 of that report:

"The approach to the entrance is from the southeast, and the deeper channel is around the end of the east jetty. All the study charts show the channel in this position, and from observations made from a number of floats, I am of the opinion that this channel is due to the flood currents. On the ebb the floats took direction straight out, and about parallel to, the general direction of the jetties and toward Point Firmin." On all jetties where I have had experience or have examined or studied this result occurs. It is not necessarily the flood current, but the coast or littoral current flowing in this case north and westward, banking up against the east jetty and flowing around it and cutting into the obtruding bar; the contour then shows this current to be moving off this point toward Point Firmin, and the ebb currents

coming out of the harbor, of course, take the same direction, crowded over by the littoral current. The existence of this current is further shown by the following facts:

I am reliably informed that at Wilmington the effect of the northerly or westerly current along the coast was plainly indicated when, some years ago, the material dredged out of the Wilmington Channel was dumped from the scows in the easterly angle of the jetty, it was found that this material was washed back into the entrance channel at the end of the jetties and it was necessary to find some other place farther out at sea for dumping the material. If the contour map of San Pedro Bay be examined it will be seen that the currents and their depositing action have located the curves of various depths, and that Point Firmin has thrown these curves outward. In my opinion, if a breakwater connected with Point Firmin should be projected, as it has been proposed, about three-quarters of a mile farther out into the sea, there would be restored what were probably ancient conditions before this point was washed away by the action of the waves and currents, and that all of the contours would move out this additional distance of three-quarters of a mile, or, in other words, would make a deposit in the protected harbor about 4 fathoms, or 24 feet, in depth, and that in a comparatively brief period. One of the engineers, Mr. Hawgood, who appeared before the Senate committee in advocacy of a breakwater at San Pedro, criticised, and I think correctly, in 1895 in a discussion before the Engineers and Architects' Association of Southern California the plan of the Board of Engineers of 1892, and he considered this depositing action of sand of sufficient consequence to propose an inclosed harbor by the building of an arm corresponding to that proposed to be built by the Board from Point Firmin.

The very serious dilemma in which the two Boards of Army Engineers found themselves in designing a breakwater at San Pedro I so fully discussed myself before the Senate committee on June 19, 1894, that I will, in order to save time, refer the Board to my discussion of that subject on pages 5 and 6 of bound Volume IV, being copy of remarks made before the Senate committee; in other words, the first Board, recognizing the great advantage of having two openings for navigation and to be used alternately for entering the harbor under various wind and wave conditions, and also to afford a free movement of sand-laden inshore currents, left an opening which the second Board believed would be productive of very serious disturbance to the harbor to be protected, and this second Board chose to take the chances against the silting up of the harbor and proposed to connect their dike with the shore. The great disadvantage of having only one opening for sailing vessels for entering the harbor is understood by navigators, and I have no doubt they will agree with the opinions of the first Board on this subject. I think the dilemma in which the Board found themselves can not be more forcibly stated than in the discussion of this part of the subject by Senator Frye in his speech:

"It is called the inner harbor. It is the inner harbor of Wilmington which has been talked about. The harbor which it is proposed to make at San Pedro is here [indicating]. Now, here is the remarkable fact to be noted. The first Board of Engineers found that if a breakwater were attached to the shore and run eight or ten thousand feet from shore, the harbor made by it inside would certainly fill up with sand, and in that Corthell and Hood concur. So the three army officers and the two civil engineers agree that if a breakwater is so attached and extended from the shore the harbor will fill up. What did the first Board do? They provided for that reach of breakwater, then an open space of 1,500 feet right in the harbor, then a breakwater running off in this direction [indicating]. Which is the direction of the southwest winds? There it is. Senators can all see it. Exactly straight into the 1,500 feet the first Board of army officers left open. Is there any safety in that harbor? Can any ship lie there in a heavy southeast gale when southwest waves are coming in?

"How happened it that the army Board of Engineers made such a blunder? It happened simply because they did not know that a southeast gale on shore was accompanied by a southwest wave line from the ocean. That is all. They made a profound mistake because they did not make the necessary inquiry. There is not a Senator on this floor who does not know that they made a mistake. There is not a Senator here who can not see that if they had made it on purpose to receive the southwest wave line they could not have placed it in any better position. There it is, right straight in." (See p. 1, Senate discussion.)

(5) The holding ground for anchorage at Santa Monica and at San Pedro is shown by the results of borings to be clay, sand, and gravel, with some limited rocky areas cropping up at the latter place. The profiles of borings and of the pile-driving record at Santa Monica illustrate the kind of material found on the bottom of these bays. The details in regard to this feature of the subject will be more fully stated by others better able to discuss it.

(6) The examinations made by the Board, and the charts and photographs, all show that there is no suitable space for even one railroad track under the wave-washed bluff at San Pedro, but that at Santa Monica there is ample room for any desired number

of tracks in addition to those already existing. With the provision in the act itself requiring the Southern Pacific Company to make satisfactory arrangements for other roads to enter on or cross its tracks and right of way, and as the president of that company has offered to build for \$10,000 per mile ten more tracks, there need be no further discussion of this subject. Further, an examination of the proposed harbor at San Pedro and the location of the two railroads there will show that the Southern Pacific has entire control to the only possible approach to the projected harbor, and that the tracks of the railroad on the east side of the river, the Los Angeles Terminal Railway, can not reach the area under this breakwater without crossing the entrance channel to Wilmington harbor. It is very doubtful, even if this were practicable, whether the Federal Government would permit a drawbridge to be built at such a place. Mr. Hawgood, in bound Volume III, explains the situation very clearly, and the following is quoted from page 7 of that exhibit:

"It is also materially deficient in facilities of establishing railway communication with the anchorage. On the west side only could direct connection be established between ships and railway. That side is now fully occupied by one railway and it is not practicable with any reasonable expenditure to give access to another. There is no more available room than that needed for the business of one road. From the north end of the town of San Pedro at Bosky or Smiths Island to the shore end of the breakwater, and beyond, the bluff is 60 feet high. All the narrow shore from Bosky to near Timms Point is full of tracks now. From Timms Point to the breakwater, with small exception, the waves break at the foot of the bluff with full exposure to the southeast. To cut away the bluff from Bosky Island toward Timms Point would bring down part of the town of San Pedro, while construction from there along the foot of the bluff would be undesirable on account of grades and complicated as to right of way. The position is such that as a business proposition one road only, the one that now occupies the west shore, could reach shipping by wharves. All other roads would have to lighter to and from deep-draft ships. A harbor of such restricted accommodations will not answer public requirements."

From these physical and commercial conditions the only free deep-water harbor possible is at Santa Monica, Port Los Angeles; that at San Pedro is almost inaccessible and in any event the approach for railroad purposes would be very inconvenient, expensive, and restricted.

All of the above-discussed six points have already been very ably stated by Mr. Hood in documents already in your hands. (See Bound Exhibits A, B, C, and D.)

(7) Another important advantage at Port Los Angeles is the existence there already of a deep-water pier, projected into the harbor to be protected, and the use of which the owners are obliged under the law to share with other companies. At San Pedro there is nothing whatever in the proposed harbor in the way of commercial facilities. On the large map exhibited is a suggested plan for sufficient wharf facilities for many years to come and for several railroads. These piers would be protected by a breakwater located as shown on the exhibited map. One of the engineers of the Board of 1892—Colonel Hains—expressed an opinion before the Senate committee that this breakwater would protect those piers.

(8) Experience has proven that the favorable nautical conditions at Santa Monica make it entirely practicable to load and unload vessels in almost any weather without inconvenience, delay, or damage. A large number of statements of shipmasters that have used the Port Los Angeles Wharf are referred to. (See Exhibit 37.) Also a digest of affidavits of shipmasters testifying to these favorable conditions, given on pages 68 and 69, bound Volume VI, being Report of Hearing before the Senate Committee. I also submit a number of statements made by shipmasters and others recently compiled. Some of these shipmasters and nautical experts will appear at the proper time before the Board to give their testimony to the superior advantages of Port Los Angeles.

(9) Most of the coastwise business, both passenger and freight, is between the city of Los Angeles and San Francisco and other northerly points. Santa Monica is 35 miles nearer these points than is San Pedro. On all business requiring quick delivery, or where time is of any importance, Port Los Angeles has great advantage. Mr. John M. Crawley, assistant general passenger and freight agent, Southern Pacific Company, addressed a letter to me at my request for information of what time would be saved to passengers and freight by using Port Los Angeles instead of San Pedro. This letter is filed under bound Exhibit 1. It shows that practically nearly one entire day is saved. This difference is based on the usual running time and the average time for unloading cargo, assuming that each port would have the same amount of cargo, and that the facilities for unloading from ship and loading into the cars are as good at one point as another. I need not refer further to these commercial features, or to the amount or character of the business that is regularly done at Port Los Angeles. A complete statement of every ship that has done business at this port during the last year will be filed with your Board, and will show that the business is a deep-water harbor business in the broad sense of the term.

(10) I think that it may be stated that the successful experience in transacting commercial business for about three years at the Port Los Angeles pier makes it evident that even if a breakwater were built at San Pedro and not at Santa Monica the principal commercial business of southern California would still be done at Port Los Angeles.

(11) In reference to the comparative cost of a breakwater at Santa Monica and San Pedro, the greater exposure at the latter place would necessitate a section much larger than at the former, the rock or the concrete blocks to be of greater size, the slopes flatter, and the work generally much more expensively constructed. I believe it to be a safe estimate that the cost to accomplish the same purpose would be one-third greater at San Pedro than at Port Los Angeles, and as to the establishment of piers immediately behind a breakwater at San Pedro and connected with it, or the laying of a railroad track or tracks on the top of such a breakwater in such an exposed situation, is, in my judgment, entirely impracticable, and even if built can not be successfully operated with the waves almost constantly breaking over it.

(12) Objections have been made to an isolated or detached breakwater at Port Los Angeles. Major Raymond, in his testimony before the Senate committee, said that he did not recollect any similar breakwater. As I had seen several such breakwaters in Europe and this country, I had an investigation made which I am glad, in the way of general information, to submit to the Board. The list comprises 33 detached breakwaters, the descriptions cover 38 typewritten pages, and 5 sheets of sketches, showing locations and cross-sections and materials. Thirteen of these breakwaters, five in foreign countries and eight in the United States, are practically parallel to rectilinear shores, and there is nothing in the reported history of these works to show that they have not performed the purpose for which they were constructed. There are a sufficient number of these detached breakwaters in various parts of the world parallel to rectilinear shores to lead Mr. Vernon Harcourt in his book on the subject of Harbors and Docks to consider them a type of harbors, and on page 80 we find the following:

"In the second type the detached breakwater forms and shelters the harbor, but instead of stretching partly across a natural bay [as his first type does] it runs parallel to a straight line of coast and protects a series of moles or jetties, projecting at right angles from the land." This comes as near describing the exact conditions at Santa Monica as could possibly be written.

I have now presented briefly the promised proofs of the superior advantages of Port Los Angeles. These will be elaborated, amplified, and extended by other witnesses more familiar with the details of the physical and commercial conditions, and more experienced in dealing with them. I have drawn the outline of the argument; others will fill it in, and demonstrate to your entire satisfaction, if I have not done so, that the deep-water harbor should be located at Port Los Angeles.

DECEMBER 21, 1896.

E. L. CORTHELL.

[Extract from Pacific Coast Tide Tables, 1897.]

Station.	Tidal differences.				Ratio of ranges.	Range of tide.			
	Time.		Height.			Mean.	Spring.	Neap.	Great tropic.
	H. W.	L. W.	H. W.	L. W.					
	A. m.	A. m.	Feet.	Feet.		Feet.	Feet.	Feet.	Feet.
San Pedro.....	+ 0 02	— 0 09	+ 0.4	+ 0.1	1.07	4.1	5.5	2.5	6.3
Santa Monica.....	+ 0 04	— 0 04	+ .6	+ .1	1.13	4.3	5.7	2.6	6.4

To the Harbor Commission, December, 1896:

NOVEMBER 23, 1896.

The undersigned business men and property owners of Los Angeles and vicinity beg to assure you of their belief that, unless serious technical reasons to the contrary should intervene, the commercial interests of this section will be best subserved by the selection of San Pedro as the location for the Los Angeles harbor, for the reason that at San Pedro the harbor will be free to all railways that may desire to enter, an advantage that can not be enjoyed at any other point now under discussion.

As proof of the sincerity of our position in this matter, we desire to state that we who sign this petition have not and will not sign any petition addressed to your Board in favor of any other locality than San Pedro.

(Signed by 545 merchants and manufacturers.)

JOHN G. WALKER, *Rear-Admiral, U. S. N., Chairman, and*
 AUGUSTUS F. RODGERS, *Assistant, United States Coast Survey,*
 Mr. WILLIAM H. BURR,
 Mr. RICHARD P. MORGAN,
 Mr. GEORGE S. MORISON,

Of the Board for Locating a Deep-Water Harbor in Southern California.

GENTLEMEN: After the able presentation of the subject which has been made to you by Mr. E. L. Corthell, an engineer whose reputation for experience and success in river and harbor improvement and other great engineering works is known, not only to yourselves, but to the civil engineers of the whole world, I feel that there is no occasion for me to occupy your valuable time, excepting, perhaps, to present for your consideration as brief an account as may be of the general situation in the bays of San Pedro and Santa Monica, together with some account of the commercial history of the two localities, of which history, being an officer of the Southern Pacific Company, I can properly speak, as that company has handled the rail transportation of the greater part of all the freight of all classes that has entered or departed from either of the two bays by vessel since railroads have been constructed at all in southern California. On this last subject I regret the unavoidable absence of the assistant general passenger and freight agent of the Southern Pacific Company, Mr. John M. Crawley, whose perfect familiarity with the subject would have enabled him to speak to you much more effectively than it is possible for me to do. Also, from having myself for some time had occasion to investigate the harbor question, I may be able to answer some of the questions that may suggest themselves to you.

When the names of the members of your Board were made public, it had not occurred to me that there would be any arguments made on the subject before you by those whose opinions or interests caused them to believe in the one or the other of the two bays as the proper location for a deep-water harbor, as the members of the Board were evidently very much more competent to decide the matter than anyone directly interested was likely to be; and evidently such matters bearing on the subject as land ownerships, alignment and grades of railroads, etc., could be readily and accurately obtained from public records and from the engineer officers of the several railroad companies if you should so desire. And there is certainly no physical characteristic whatever of the localities in question that is not plainly and unmistakably evident upon an examination of the kind that a Board of acknowledged experts would surely make.

As you have kindly consented to hear those who wish to present their views, however, it becomes expedient for all parties to appear.

Considering, for convenience, that the deep-water harbor is to be formed by the construction of a rubble breakwater in a position in Santa Monica Bay somewhat as shown near Port Los Angeles on the blue print chart of Santa Monica Bay, scale 1-50,000, five copies herewith, and the blue print chart of a portion of Santa Monica Bay, scale 1-10,000, four copies herewith. These blue prints are from a tracing of the United States Coast Survey charts, with the wharves, breakwater sites, etc., added.

Or that the deep-water harbor is to be formed by the construction of a rubble breakwater, situated to the eastward of Point Firmin, in San Pedro Bay, somewhat as shown on blue print No. 3953, scale 1-50,000, five copies herewith, on which are shown the two plans of breakwater as proposed by the two successive Boards of Engineers of the United States Army, which two Boards differed radically as to very essential details of construction.

Also, I submit blue-print chart No. 2389, Wilmington and San Pedro harbors, scale 1-10,000, four copies herewith, on which are shown the position of breakwater recommended by the Board of Engineers, United States Army, of which Board Col. G. H. Mendell was chairman; these prints being made from tracings, as indicated thereon, with proper additions of railroads, breakwater sites, proposed wharves, etc.

When it was first proposed to establish a deep-water harbor in San Pedro Bay substantially as shown on blue print No. 2389, which print was made from a tracing which I was kindly allowed to have made by one of my draftsmen from the original tracing on file in the office of the United States Army engineers in San Francisco, there had been very little attention given to the matter by transportation companies.

Acting on the hypothesis that the matter had been well considered by the United States Army engineer officers, the Southern Pacific Railroad Company secured a right of way and station grounds suitable for the prospective business, the station ground being shown in red on blue print No. 4594, and extending from the north line of the tract marked "Town of San Pedro Harbor" to the shore end of the proposed breakwater. These station grounds include the greater part of the shore line fronting on the proposed harbor to be protected by the breakwater. There was also secured for real estate purposes the large tract of land lying to the westward of these station grounds, the ownership of which is at present seven-eighths in the Pacific Improvement Company and the remaining one-eighth in contest.

The precise state of this ownership at present is shown in Exhibit No. 1 herewith. The Southern Pacific Railroad was extended from San Pedro to a point near the shore end of the proposed breakwater and a wharf commenced with very little study of the question, as it was evidently correct to build in the direction of deep water while constructing the trestle approach portion of the wharf, and as this would take some time, owing to the bottom being a shaly rock for more than 500 feet out from the shore, requiring expensive and slow methods of inserting the piles in the rock bottom, it was expected that the proper design for the position of the wharf which should be in deeper water than $4\frac{1}{2}$ fathoms and at which portion large ships should berth could be studied and defined by the time it was needed in the progress of the wharf construction.

It was well known that the large ships which then were accustomed to anchor to the southeastward of Deadmans Island in appropriate depth of water were much troubled by the ordinary swell from the westerly while transferring their cargoes to lighters, this swell in the absence of local storms being often very heavy and its direction being about north 45° east magnetic at a general average under ordinary conditions. The existence of the proposed westerly entrance of the harbor so situated as to allow this westerly swell to enter the harbor with considerable effect presented a difficult problem as to the proper direction for the portion of the wharf at which ships should berth. We considered that it would be imperative to curve this portion of the wharf to the southwestward to be head on to the direction of this swell after it should have entered the harbor, accomplishing the necessary change of direction of at least 90 degrees by a sharp curve. A very slight examination of the matter will show a very peculiar situation if this plan were carried out, with one or more wharves, their ship-berthing portions not very far from parallel to the anchorage area protected by the breakwater. Besides this, the heavy storm waves, which always accompany our southeast gales, these waves coming in from about south 30° west magnetic, and the southeast storm winds having a direction of about north 54° west magnetic, would come into the western entrance of the proposed harbor with even a worse direction for producing movement of ships at wharves than the waves of the ordinary swell.

We were much discouraged by these considerations and were very uncertain how to build the berthing end of the wharf, and commenced considering a modification of the proposed breakwater which would overcome these difficulties and which would be of such a character that we could with propriety call the attention of the United States Army engineers to the advisability of such modification.

The only solution of the difficulty seemed to be to close the westerly entrance, either by continuing the shore arm of the breakwater across the proposed westerly entrance, which would materially increase the cost of construction of the breakwater, or by curving continuously from the shore end of the breakwater somewhat as proposed by the Board of United States Engineer Officers, of whom Col. (now Gen.) William P. Craigill was chairman, which plan would very considerably increase the anchorage area in the protected harbor. On further investigation we found this closing of the westerly entrance would probably be disastrous, both from causing shoaling of the proposed deep-water harbor and that it would probably entirely ruin the present inner harbor, as has been so fully explained by Mr. Corthell. An inspection of the blue-print charts, and especially of the second chart in Ex. Doc. No. 41, Fifty-second Congress, second session, showing that the prevailing westerly or up-coast shore current has caused the several fathom curves to be far from shore in the indentation between Long Beach and Point Firmin, in which indentation the present entrance to the inner harbor is situated, and the artificial extension of Point Firmin as proposed by a continuous breakwater from the shore would certainly cause a further drawing offshore of the several fathom curves, besides an eddy shoaling of the deep-water harbor proper, as well as beyond doubt making the maintenance of the easterly extremity of the proposed breakwater an interesting and expensive procedure. In addition, as the general direction of the heavy storm waves from south 30° west magnetic would be oblique to the axis of such a breakwater for the greater part of its length, the well-known and disastrous effects caused where waves "race" along an obstacle not essentially at right angles to their direction would occur, and require either a very expensive and substantial character of first construction or constant damage would occur, with consequent expense for repairs.

By the time these considerations had been grasped it was evidently the time to stop the construction of the wharf, which was still progressing under considerable difficulties and hence, fortunately, slowly. We stopped it, and the whole San Pedro outer-harbor matter, breakwater, wharf, and sundry investments, as well as the cost of the portion built of the wharf, are not our favorite subjects for pleasant reflection.

The Pacific Coast Steamship Company had called the attention of the Southern Pacific Company to the excellence of the portion of Santa Monica Bay to the westward of Santa Monica Canyon as a site for a wharf at which their largest steamships could berth and connect direct with railroad trains for freight and passengers. I was directed to investigate, and commenced to study Santa Monica Bay.

It was evident on examination that it was not advisable to build a wharf very far to the westward of Santa Monica Canyon, as the shore commenced soon to curve too much to the westerly, giving a lee shore too close to a wharf built in such a position, the same as at San Pedro outer harbor, so near as to give a vessel parting her ground tackle very little time to anchor again or get under way.

At San Pedro the well-known numerous wrecks from this cause need not be detailed here, as the facts are easily ascertainable.

After proper study the present situation of Port Los Angeles Wharf seemed to meet all the conditions best for a wharf not protected by a breakwater, and we designed the wharf essentially as now built, with the trestle approach running out about square to the fathom contours to about $4\frac{1}{2}$ fathoms, and then curving to be head-on to the general direction of the heaviest ordinary westerly swell, which direction was ascertained by careful and continued observations; and at this point there is a very considerable distance in which a ship might drift with a southeast gale in case of accident to her ground tackle before getting into dangerously shoal water. Also, the question of a breakwater was then given attention, in considering the appropriateness of general situation for future improvements.

The breakwater site considered by the Board of United States Army Engineers, of which Col. G. H. Mendell was chairman, which site is south from the town of Santa Monica, was evidently much exposed to winds and waves from the north and northwest, and did not have the advantage of the protection afforded by Point Dume from the ordinary westerly swells, which are sometimes quite heavy at and southeasterly from the town of Santa Monica. A very noticeable feature of the vicinity of Port Los Angeles was the distance between the $4\frac{1}{2}$ and 7 fathom curves, or the $4\frac{1}{2}$ and any other fathom curve that might be selected for the axes of a breakwater, this being more marked than at any other portion of the bay and indicating the greatest protected area with any given cost of construction and length of breakwater. I need only mention the protection the Cahuenga Mountains afford from north and northwest winds, and the map is sufficiently eloquent as to the southeasterly gales.

The heavy storm waves come as usual from the direction of about south 30° west magnetic, which is nearly normal to the shore line and to the greater part of the proposed breakwater, thus diminishing the tendency to destructive action on a rubble breakwater by the "race" of the waves.

The breakwater would be essentially parallel to the westward shore currents; hence, with no danger of shoaling, would have ample width of entrance at either end, and could in future be extended farther eastward if ever required.

The whole situation seemed a favored one, and the construction of the present Port Los Angeles Wharf was commenced.

Blue-print chart of Santa Monica Bay, scale 1-50,000, five copies herewith, and chart of a portion of Santa Monica Bay, scale 1-10,000, four copies herewith, illustrate quite fairly these considerations.

This wharf was commenced without any fears as to the result. It was built as strongly as we knew how to build a timber wharf, and was intended to withstand storm waves of considerable size, which would not be necessary in the existence of a breakwater.

We had no expectation of being able to continue the unloading of cargoes during storms, and expected in such cases to haul off ships and anchor them, the idea being that during all of some years and during the greater part of the worst years we could do the work of delivering and receiving cargoes. We had no fears as to the character of the holding ground, as the preliminary borings had settled that question satisfactorily. There has been very little trouble; very much less than we expected.

Mr. J. A. Muir, superintendent Los Angeles division Southern Pacific Company, will present a full account of what few difficulties have been met with, as for instance the trouble with the ship *Dunboyne*, March 2, 1896. It is very satisfactory to have had some trouble of this character, as it demonstrates that although Port Los Angeles is a remarkably good harbor in its present condition, it still requires a breakwater to make it entirely secure at all times and to give proper confidence to owners of ships.

If there is any information as to difficulties from waves, or injury to ships at Port Los Angeles which may have escaped Mr. Muir's memory as seeming to him unimportant and unthought of in the pressure of his arduous duties, it will be a favor to us if, at the proper time, anyone having knowledge of such cases will bring them to the knowledge of the chairman and members of this Board, as strengthening our contention that although Port Los Angeles is a very good harbor now, it would at times be much better if protected by a breakwater.

Some questions have been raised as to the character of the holding ground at the respective harbor sites. At the San Pedro proposed deep-water harbor we have some definite information; perhaps the only definite information at present in existence.

We made a line of borings on the line of the proposed wharf, as shown on blue-print charts No. 2389 and No. 3953. These borings are shown on blue print profile No. 3959, five copies herewith.

The rock croppings extend from shore to beyond extreme low tide and somewhat farther out, the exact distance being unknown.

Our first boring was somewhat more than 1,000 feet out from the shore. So far as these borings go the holding ground seems good enough.

It will be noticed that blue print chart No. 2389 shows very considerable areas of kelp in the deep anchorage portions of the proposed San Pedro outer harbor. Kelp has often been considered definite evidence of rock bottom, but I do not so consider it. Kelp always attaches its lower extremity to some sort of hard mineral substance so far as my experience goes, and generally to rock, but the size of the rock is a matter of indifference. It may be a rocky ledge of great extent, or it may be a small cobble or large piece of gravel, or even a shell of suitable character.

Hence I do not consider the areas of kelp shown on blue print chart No. 2389 to be necessarily evidence of rocky bottom throughout where the kelp exists.

There are no doubt occasional croppings of rock ledges, and possibly more rocks still to be discovered, like the one discovered in 1887 with but 18 feet of water over it, and shown on blue print chart No. 2389.

But I am of the opinion that the greater part of the kelp shown on this chart indicates a bottom with considerable small cobble, large gravel, etc., on the surface of the bed of the ocean.

I would like here to offer for inspection some instances of kelp attached as I have before described which were obtained from Port Los Angeles.

It is evident that the holding ground is not as good with any considerable amount of small cobble and large gravel, etc., on the surface of the ocean bed as if it were some more favorable material, and to this extent the kelp indicates inferior holding ground.

It would seem that for other reasons the presence of any considerable quantity of kelp in the anchorage ground of a protected harbor would be somewhat undesirable.

At Port Los Angeles there is no kelp of any consequence outside of the 4-fathom line in the vicinity of the wharf or eastward from it. This is fully shown on the blue-print chart of vicinity of Port Los Angeles, scale 1-10,000, dated 1893, two copies herewith, the completeness of which chart has always excited my admiration for the methods of the United States Coast and Geodetic Survey.

From the indications of the borings taken in advance of the construction of Port Los Angeles Wharf, as shown on blue-print profile No. 3867, four copies herewith, and profile No. 3956, of borings taken from mouth of Santa Ynez Canyon toward and near the line of a part of the proposed breakwater, five copies herewith, and the blue-print sketch illustrating the position of the borings shown on the last two mentioned profiles, the holding ground would seem to be excellent. This, with the absence of any considerable quantity of kelp in the anchorage ground (which kelp if present would indicate the same objectionable features mentioned as existing at San Pedro outer harbor site), together with the fact that no trouble has been had with ships at anchor from defective holding ground, would make any further discussion of the subject by me seem unnecessary, but I will here submit four blue-print profiles, No. 4341, of Port Los Angeles Wharf as constructed, which in showing the penetration of the piles into the ocean bed somewhat indicates the material.

These profiles also show sundry matters of interest, including the general slight deepening of the water since the construction of the wharf.

The clay stratum shown on the profiles of borings in Santa Monica Bay, blue prints of which have been previously referred to, is of very great and, at present, unknown thickness.

This fact was discovered by an attempt on our part to bore an 8-inch diameter well for water supply through the clay at a point near the turntable at the engine stalls near Port Los Angeles. We bored one well 475 feet deep, tools got broken, etc., and the well was abandoned. We then bored another well a few feet away from the first, and at 532 feet deep the tools were broken and well abandoned as before without getting through this clay bed, which was a firm blue clay with a slight sprinkling of fine sand and an occasional indurated layer of slight thickness, which was slowly bored with our water-jet boring method.

The existence of so thick a clay bed near the shore end of Port Los Angeles Wharf would seem to indicate the extreme improbability of any rock formation existing in the bay within a considerable distance of the point at which these wells were bored.

Cost of wharves built by individuals or corporations to utilize the area protected by breakwater for other than a mere harbor of refuge is an important matter in considering the proposed sites. The portion of a wharf which is in 30 feet or more depth of water may be considered the only portion of such wharf which is available for berthing deep-water ships.

The amount of wharf necessary to be built between the shore and the depth of 30

feet, or the 5-fathom line of the Coast Survey charts, may be considered as of little use except as a means of reaching the wharf proper, and it is important that its cost is not too great.

At the Santa Monica Bay site the 30-foot or 5-fathom curve is nearly uniformly five-eighths of a mile from the shore, and the shore opposite the breakwater site has ample width above high tide at the foot of the slopes of the table-lands for the approaches to such wharves by wagons or railroads.

At the San Pedro Bay site the 30-foot or 5-fathom curve is from one-half to five-eighths of a mile from the shore at the extreme westerly end of the proposed breakwater, and this distance increases rapidly in the easterly portion at the proposed protected area until it becomes $1\frac{1}{2}$ miles of commercially useless wharf to be built to reach the 30-foot or 5-fathom curve, where the available deep-water wharf would begin. That is, there is a place for one wharf only at San Pedro Bay site which is as favorably conditioned in the respect above noted as are all the future wharf positions at the Santa Monica Bay site, and all other wharves that may be built at the San Pedro Bay site situated easterly therefrom would be increasingly more costly than those which would be built at the Santa Monica Bay site.

Also the shore at the San Pedro Bay site is a rocky bluff about 60 feet high, the base of which is washed by high tides, and along the foot of which bluff there is no opportunity for access by wagons and railroads.

The business to be done at wharves in a deep-water harbor in the general locality in question consists mainly of three kinds, namely:

(1) Freight and passengers carried by the large steamships engaged in the coasting trade. As this freight and passenger business is principally between San Francisco and Los Angeles, it is evident that a port as far north as the topography of the country in the vicinity of Los Angeles will admit of will do the principal business, as south-bound steamers arrive sooner and north-bound steamers depart later from such a port so situated than to and from any port to the southward of such a site.

It is a fact that passengers and freight arriving at the Port Los Angeles Wharf of the Southern Pacific Railroad Company in Santa Monica Bay are delivered by rail in Los Angeles before the steamer by which they came reaches San Pedro Bay.

(2) Freight by ocean steamers and sailing vessels to and from Isthmus, South American, Australian, etc., ports habitually sight Point Concepcion Light and thence work down the coast with the prevailing westerly winds, and if bound for San Pedro Bay would pass Santa Monica Bay.

Ocean steamers from foreign ports would go to the one bay about as readily as to the other, so small a difference in distance being of no consequence in a long ocean voyage.

(3) Lumber in small steam and sailing vessels from ports in northern California and Washington, and coal from Washington and British Columbia, these classes of freight would evidently find a port in Santa Monica Bay the nearest of the two, and very considerable quantities of coal and lumber have been received at Port Los Angeles Wharf in Santa Monica Bay.

A considerable quantity of lumber in coasting vessels of light tonnage still goes to the San Pedro inner harbor chiefly on account of lumber yards and mills heretofore established there.

From these considerations it is plain that any person or corporation building expensive wharf facilities in San Pedro Bay, should a deep-water harbor be constructed there, would find themselves deprived of the important freight and passenger business between Los Angeles and the northern coastwise ports, which business would continue to be principally done at Port Los Angeles in Santa Monica Bay, and no person or corporation after examining the commercial situation would feel justified in going to the expense of building the necessary wharves, etc., at San Pedro Bay for such a partial business as would be their portion.

Referring to the large diagram map on which are shown the Port Los Angeles Wharf and sundry wharves that may be built if expedient, it will be noticed that the easternmost of these wharves is nearer opposite the east end of the breakwater than the present Port Los Angeles Wharf is to being opposite the westerly end of the proposed breakwater. It will be noticed that they are in this position about equally protected from the heaviest ordinary swell as being the most important as the one of most frequent occurrence.

The most eastern proposed wharf is more exposed to the more rarely occurring heavy storm waves coming from about south 30° west than the present Port Los Angeles Wharf.

The question has been raised whether a breakwater situated as shown will protect wharves between it and the shore. This question has been befogged by technicalities. No question would arise as to the protection afforded by an island 1.6 miles long and lying parallel to the shore. The proposed breakwater will be simply an artificial island of corresponding dimensions and position.

Regarding the property of the Southern Pacific Railroad as affecting the approaches

to the several deep-water harbor sites, blue print No. 4594 shows the property at San Pedro and blue prints No. 4595 and T. 37, four copies of each herewith, show the property at Santa Monica. I should state that a portion of the area shown as the property of the Southern Pacific Railroad has been allowed to be overridden by wharf franchises granted to lumber firms whose business is tributary to the Southern Pacific Railroad. It is all a matter of record.

At Santa Monica the Southern Pacific Railroad owns the property as shown, the details being a matter of record and can be furnished, if desired. In addition, the Santa Monica Heights tract, fronting on the ocean from a point just west of Santa Monica Canyon to a point near the engine stall west of the shore end of the wharf, was purchased by Mr. C. P. Huntington as private property, and so far as I know is still in his name or control.

The opportunity for a very considerable number of tracks to be constructed between the present railroad and high tide has been stated by Mr. Corthell, and is apparent on the ground to the most casual observer.

Considerable stress has been laid on the obstacle to other railroads presented by the Santa Monica Tunnel.

This tunnel, ordinarily, never would have existed, but would have been an open cut. The people of Santa Monica desired the tunnel and it was built. It was 331 feet long, cost \$6,879.92, or \$20.78 $\frac{1}{2}$ per foot run, exclusive of freight on the timbering. (For details see Exhibit No. 2.)

In addition, it was necessary to remodel a portion of the Ocean Avenue Street Bridge in building the tunnel. The cost of this was \$498.76. (See Exhibit No. 3.) Just west of the tunnel a short distance is a large and fine bath house separated from the present railroad by the county road. In the event of changes of the bath house and county road being inexpedient, it is a simple matter to build as many tracks as desirable to the right or northerly from the present tunnel, either in additional tunnels or with more usual and sensible construction by one wide, open cut for holding as many tracks as desired, carrying the street of the town over those tracks by bridges in the usual manner, and so modifying the alignment locally that the Southern Pacific Railroad would take the right hand or northerly one of these new tracks and returning to its own present track at a suitable distance beyond the bath house.

Any cutting away of bluffs or tunneling, or such form of construction as should be found best, would cost an amount not worth considering.

I tender my excuses to the chairman and members of the Board for occupying their time with so insignificant a matter.

Anyone who would advance objections to the cost of the necessary work at this point certainly has an idea that the railroads ought to be found, in nature, ready built, free of cost.

An argument has been made in favor of the form of breakwater beginning at the shore, to the effect that it would be available for a railroad track, serving wharves built from the protected side of the breakwater. That is, a railroad on a breakwater in 7 to 9 fathoms of water, with the top of the breakwater 10 feet above high tide. Consideration of anything of this sort is an evident waste of time.

The question has been raised whether a wharf built of wood is not more subject to attack by the teredo and limnoria if in calm water behind a breakwater than if in an unprotected locality where there are waves. I know nothing about this. If it is founded on experience it demonstrates that wharves in a protected harbor should be built with supports of material that will not be attacked by the teredo and limnoria; or perhaps it demonstrates that protected harbors should never be built.

As showing the confidence now entertained as to the present safety of Port Los Angeles, I submit Exhibit No. 4. It shows that the insurance rate to all Southern California ports in winter is alike, viz, 2 $\frac{1}{2}$ per cent, which is one-half per cent more than the insurance rate to San Francisco.

In previous harbor-question hearings a feature has been the presentation of petitions in favor of the several harbor sites. (For example see Ex. Doc. No. 41, Fifty-second Congress, second session.) I need not enter into the detail of the familiar methods by which signatures to petitions are often obtained. These methods often illustrate the same qualities of the human mind displayed in getting the signature of letters of personal recommendation for employment. Sometimes the same individuals kindly sign the petitions of both the opposing interests.

If the opinions of shippers are wanted, I think traffic statistics are better indications than signatures to petitions.

I submit herewith as illustrating this matter, Exhibit No. 5, giving date, name, registered tonnage, from what port, and the cargo of every craft, exclusive of Pacific Coast Steamship Company's steamers that has arrived at Port Los Angeles up to and including December 10, 1896. It is interesting reading.

Also Exhibit No. 6, being a statement of the Los Angeles and ocean traffic in pounds, pertaining to the Pacific Coast Steamship Company's steamers for the twelve

months ending August 31, 1896, including all ports and all railroads that handle the business. This exhibit illustrates the true opinion of the merchants of Los Angeles as to the merits of Port Los Angeles.

Also Exhibit No. 7, being a complete statement of tonnage passing the ports of Port Los Angeles and San Pedro for twelve months, July 1, 1895 to June 30, 1896, inclusive, very elaborately classified.

I think these traffic exhibits will prove of interest, and it would appear that Port Los Angeles is a permanent institution whether a protected harbor be built there or not.

I beg leave to present Exhibit No. 8, giving rail distances from sundry points to the respective deep-water harbor sites and other points all by rail via the Southern Pacific Railroad, which distances may be of service.

Any information in the way of maps and profiles of railroads that may be desired by the Commission will be furnished by the Southern Pacific Company, and doubtless by other railroad companies. And any further data of any character that the Commission may desire to facilitate their labors will be freely furnished.

In conclusion, I will say that it appears to me, considering the situation at San Pedro as outlined by Mr. Corthell and myself, and the situation at Santa Monica and Port Los Angeles, all taken in connection with the terms of the act making the appropriation which your Board is to decide upon the location of, that the only harbor to be properly termed free and available for the use of all railroads and individuals is the one in Santa Monica Bay.

Yours, respectfully,

WILLIAM HOOD,
Chief Engineer, Southern Pacific Company.

EXHIBIT No. 1.

SAN PEDRO HARBOR, DOCK, AND LAND ASSOCIATION.

SAN FRANCISCO, CAL., December 9, 1896.

Stock, 100,000 shares.

	Shares.
Pacific Improvement Company, 51 per cent.....	51,000
A. M. Pierson, 24 per cent.....	24,000
Held in escrow, 25 per cent.....	25,000

Property.

Land at Point Firmin allotted to A. W. Timms in partition of Rancho Palos Verdes, containing 704.92 acres (except 3 acres, light-house, on Point Firmin). The deed from Timms conveys all land from high-water mark on the shore of Pacific Ocean, such being the boundary of grant.

Land known as Government reservation, 40 acres: (1) Claimed by deed from H. B. Woodard, who occupied the land for years and made improvements; (2) by deed to Pacific Improvement Company from the Alexander family, who have title to one-half of 100 varas of this land by decree of United States court for southern district of California, dated April 3, 1861; (3) by deed to Pacific Improvement Company from A. W. Sepulveda, who owns the reversion of the 40 acres. (This land is held by the Department of the Interior to be within a military reservation, made so by an Executive order filed October 15, 1888.)

Of the above lands the association sold to Southern Pacific Railroad Company 70 acres, being the eastern portion of Timms's tract, lying on the shore of the ocean, and the deed reading "out and into deep sea;" also about 15 acres of the reservation tract, being that portion lying on the shore of the ocean.

Subsequently, by a judgment, one-eighth interest in the Timms tract was awarded to one Brock and assigns, free of incumbrances, and 25,000 shares of the association stock was placed in escrow, to secure the Pacific Improvement Company and the Southern Pacific Railroad Company against loss by reason of this award.

The Pacific Improvement Company holds an assignment of mortgage on the entire tract from the original owner, Timms, which could be foreclosed and give to them the full ownership, including the part sold to the Southern Pacific Railroad Company, unless the railroad company intervenes to redeem their right of way.

DEEP-WATER HARBOR.

EXHIBIT No. 2.

SANTA MONICA EXTENSION.

[Tunnel, 331 feet face to face of portals. Sets of timbers in general 3 feet between centers, side lagged throughout and partly extra roof braced. Plan No. 3608.]

Timbering:

Unloading, framing, erecting 150,974 net feet, B. M., at \$12 per M.	\$1,811.69
Timber (redwood), 156,888 feet, B. M.	2,351.47
Pine dowels, material	\$0.32
Oakland mill work	1.64

Total dowels	1.96
Shop irons for two portals	10.04
Nails and spikes	101.35

Total timbering	4,276.51
-----------------------	----------

(Timbering in place per net M feet, B. M., \$28.326.)

Excavation, etc.:	
Excavation by contract 2,246 yards, at 40 cents, \$898.40; 2,730 yards, at 60 cents, \$1,638	\$2,536.40
Covering with earth under street bridge	59.68

Total excavation, etc.	2,596.08
Five warning signboards (Sacto. shops), at \$1.466	7.33

Total tunnel	6,879.92
--------------------	----------

Summary:

Timbering and signboards..	\$4,283.84, or \$12.942 per foot of tunnel.
Excavation, etc	2,596.08, or 7.843 per foot of tunnel.

Totals	6,879.92, or 20.785 per foot of tunnel.
--------------	---

EXHIBIT No. 3.

SANTA MONICA EXTENSION.

Changing and rebuilding Ocean Avenue Street Bridge:

Excavating and filling foundations	\$31.76
Construction, contract price, material and labor	467.00
Total	498.76

This work was done under the direction and to the satisfaction of Santa Monica town authorities. (See receipted bill of contractor.)

EXHIBIT No. 4.

OFFICE OF THIRD VICE-PRESIDENT.

SAN FRANCISCO, December 16, 1896.

Mr. J. M. CRAWLEY,

Assistant General Passenger and Freight Agent, Los Angeles, Cal.

DEAR SIR: Respecting your two telegrams of yesterday (15th) in relation to rates of insurance quoted by Syz & Co., and Brown, Craig & Co., in 1894, on vessels destined to Port Los Angeles and San Pedro, Syz & Co. quoting rate of 1½ per cent to San Pedro and one-half to three-fourths per cent additional to Port Los Angeles; Brown, Craig & Co. quoting rates one-half per cent higher to Port Los Angeles than to San Pedro.

We called upon Messrs. Brown, Craig & Co. (now E. Brown & Son) and obtained a copy of the letter written by them to which you refer (same herewith). We

found that they are not marine insurers; that they made the inquiries for account of Mr. Ben. E. Ward, who was at that time their agent in Los Angeles; that the inquiries were not made with respect to a specific case of insurance but in a general way, which fact the letter itself makes evident. In this case it is therefore evident the letter does not express the views of anybody in particular; it is not a proposition in a bona fide case of insurance, and but purports to be an average of opinions on the subject, which would of necessity imply that some regarded the port with more favor than thus expressed.

We then interviewed Mr. Louis Rosenthal, a member of the firm of Syz & Co. (Mr. Syz being in Europe). Here we discovered that the letter you mention as being written by that firm was in reality one of those used by Messrs. Brown, Craig & Co. in arriving at the consensus of opinion which they aimed to express to Mr. Ward—the letter of Syz & Co. being in reply to an inquiry of Messrs. Brown, Craig & Co. about the time of their letter to Ward. Mr. Rosenthal, however, states that his firm has not insured any vessels either to San Pedro or to Port Los Angeles for years, and that he is not prepared to state what rates he would make at this time without further investigation, which would only be undertaken in the case of an application for insurance; that, consequently, his letter of June 13, 1894, might or might not be in accordance with his conclusions based upon such investigation; that it certainly should not be presented as representing his views of to-day, as he admits, in view of the record of Port Los Angeles, it might need a revision.

Neither of the above-mentioned letters should therefore be admitted as evidence of a consensus of opinion among insurance men to-day, as they are not claimed to be such by the writers of them. They admit Port Los Angeles is now better known; that it has a record, which at that time it could hardly be said to have had.

In order to get some idea as to how those two ports are considered to-day we made some inquiries among the insurance men. Two said outright that they would make no distinction between the two ports (having reference to vessels of deep draft, such as would have to anchor off San Pedro and lighter cargo); three did not know that they would charge any more to Port Los Angeles than to San Pedro; and one first said he would take no risks at either port in winter season, but subsequently admitted that he might be compelled to make the same rate to Port Los Angeles as to San Pedro in a case where the applicant was a customer which he did not wish to apply elsewhere. This last evidence shows how little dependence can be placed upon insurance rates in such cases. His logic would as well apply to San Pedro, and a case of such insurance be used to demonstrate that San Pedro was a preferred port.

Our opinion is that in this, as in all other business, the object of insurers is to get all they can, and whenever a new port is opened which seems to have any conditions that might be used in argument to give color to pretensions that the risks are greater there than at some other well-known place which has a record and the business to which has been the subject of competition among insurers they begin by imposing higher rates at the new, unknown, uncompleted-for port; which differences gradually disappear as the port is better known, its freedom from casualties become a matter of notoriety, and its business commands more active competition.

If such testimony is to be admitted in the present investigation an actual case of insurance should have greater weight than such noncommittal expressions as those of Messrs. Brown, Craig & Co. and Messrs. Syz & Co., especially as the latter expressly declines to be bound by the statements of several years ago. The ship *Guy C. Goss* is now at Port Los Angeles and Mr. A. M. Sutton is down there superintending her discharge. Can you not ascertain from him what rate of insurance was paid on the ship or her cargo, or both, on her present trip, and whether such rate shows any discrimination against Port Los Angeles? The rates from the Atlantic to Pacific ports are somewhat higher than in 1894, we have been told, but it is customary to charge about one-half per cent higher to these southern ports than to San Francisco; so, if you learn that the rate to Port Los Angeles does not exceed that excess over the rate to San Francisco, it may be taken as prima facie evidence of equality between the two ports; but Mr. Sutton may be able to advise you with certainty. The trouble is all the vessels of deep draft, say from the Atlantic and from Australia, have been going to Port Los Angeles for some time past, none to San Pedro; hence there is no basis for comparison among the insurance men here, though there may be in the East and abroad. The *Port Crawford*, now at Port Los Angeles, was insured abroad, as we understand it.

If anything further is desired let me know.

Yours, truly,

J. C. STUBBS.

NOTE.—Inquiry was telegraphed as to rates on ship *Guy C. Goss*, mentioned above, and the answer is as follows:

“Consignee states rate on *Goss* was same as that on *Chas. E. Moody* which arrived 23d last, viz, 2½ per cent, which is just one-half per cent more than the San Francisco rate at that time, and one-half per cent is the usual difference between San Francisco and southern ports in winter without discrimination.”

SAN FRANCISCO, June 11, 1894.

DEAR SIR: Are in receipt of your favor of 9th in re marine rates at San Pedro, Santa Monica, and Redondo. Have seen half a dozen offices on the subject and the consensus of opinion is that on deep-water ships from foreign ports there will be a difference of one-half per cent in favor of San Pedro during the summer months and of at least 1 per cent during the winter months. Two of the companies, in fact, declined to insure deep-water ships at Redondo at all, and the others say that they would prefer not to take the risks. Santa Monica is considered better, but about San Pedro there is no difficulty at all. On steamer rates there is no difference, but on sailing vessels from San Francisco there is a difference of 25 cents during the summer months in favor of San Pedro and of 50 cents during the winter months.

Trusting this will answer your inquiry,

Very truly, yours,

BEN. E. WARD, Esq.,
Los Angeles, Cal.

BROWN, CRAIG & Co.

EXHIBIT No. 5.

Freight vessels arriving at Port Los Angeles.

[Exclusive of Pacific Coast Steamship Company's steamers.]

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1893.				
May 9	Tug Collis	102	San Francisco	
11	Steamer San Mateo	1,926	Comax	4,200 tons coal.
June 1	do	1,926	do	4,300 tons coal.
9	Tug Collis	102	San Francisco	5,720 ties.
13	Steamer Newsboy	150	Navarro	42,004 feet, B.M., lumber.
15	Steamer Mineola	1,892	New York	700 tons rail; 500 tons merchandise.
17	Ship India	1,230	Nanaimo	2,068 tons coal.
23	Steamer Alcazar	202	Point Arena	8,403 ties.
26	Steamer Alcatraz	193	do	8,164 ties.
27	Steamer Whitesboro	144	Cleone	6,150 ties.
29	Steamer Westport	154	Bear Harbor	7,680 ties.
30	Steamer Sunol	194	Point Arena	8,169 ties.
July 1	Steamer Alcazar	202	do	8,341 ties.
8	Steamer Lakme	404	Noyo	9,125 ties.
10	Steamer Greenwood	144	Cleone	6,240 ties.
10	Steamer Alcatraz	193	Noyo	9,400 ties.
11	Steamer Whitesboro	144	Point Arena	6,352 ties.
12	Steamer San Mateo	1,926	Comax	4,300 tons coal.
13	Steamer Sunol	194	Point Arena	8,388 ties.
14	Steamer Pasadena	235	Eureka	195,000 feet, B.M., lumber.
16	Steamer Alcazar	202	Cleone	8,200 ties.
17	Steamer Newsboy	150	Navarro	6,603 ties.
18	Steamer Westport	154	Bear Harbor	7,600 ties.
22	Steamer Alcatraz	193	Point Arena	8,337 ties.
23	Steamer Whitesboro	144	do	8,160 ties.
24	Schooner M. C. Russ	150	Westport	6,964 ties.
24	Steamer Sunol	186	Navarro	7,689 ties.
27	Steamer Alcazar	194	Point Arena	8,475 ties.
28	Steamer Lakme	202	do	8,475 ties.
29	Steamer Newsboy	404	Fort Bragg	18,139 ties.
		150	Navarro	30,216 feet, B.M., lumber;
Aug. 3	Steamer Alcatraz	193	Point Arena	6,496 ties.
3	Steamer Mineola	1,892	Comax	8,396 ties.
4	Steamer Whitesboro	144	Cleone	3,100 tons coal.
6	Steamer Alcazar	202	do	6,300 ties.
6	Steamer Sunol	194	Goldwood	8,720 ties.
				18,664 feet, B.M., lumber;
10	Steamer Hermosa	249		7,932 ties.
12	Steamer Alcatraz	193	Greenwood	8,095 ties.
15	Steamer Whitesboro	144	Point Arena	6,175 ties.
15	Steamer Hermosa	249		
17	Steamer Alcazar	202	Cleone	53,480 feet, B.M., lumber;
				6,806 ties.
17	Steamer Greenwood	144	Point Arena	6,480 ties.
18	Steamer Sunol	194	do	8,631 ties.
25	Steamer Mineola	1,892	Comax	3,100 tons coal.
28	Steamer Greenwood	144	Cleone	8,840 ties.
30	Steamer Sunol	194	Point Arena	8,540 ties.

Freight vessels arriving at Port Los Angeles—Continued.

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1893.				
Sept. 4	Ship India.....	1,230	Nanaimo.....	2,089 tons coal.
16	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
20	Steamer Caspar.....	234	Caspar.....	180,000 feet, B.M., lumber.
29	Tug Pelican.....	12	Redondo.....	
Oct. 10	Schooner Bobolink.....	161	Mendocino.....	197,428 feet, B.M., lumber.
15	Steamer Jewel.....	202	Via Redondo.....	162,000 feet, B.M., lumber.
31	Steamer Pasadena.....	235	Eureka.....	112,000 feet, B.M., lumber.
Nov. 18	Revenue cutter Nympha.....	150	San Francisco.....	
Dec. 1	Steamer McArthur.....	112	do.....	Surveying cruise.
2	Bark Aumbree.....	1,329	Liverpool.....	1,200 tons merchandise.
7	Steamer Mineola.....	1,892	Comax.....	2,900 tons coal.
29	Mau-of-war Royal Arthur.....	7,700	S. Bar. (England).....	None.
30	Steamer San Mateo.....	1,926	Comax.....	4,150 tons coal.
1894.				
Jan. 23	Steamer San Mateo.....	1,926	do.....	4,150 tons coal.
Feb. 16	Steamer Mineola.....	1,892	do.....	2,900 tons coal.
16	Schooner J. Wand.....	163	Eureka.....	275,000 feet, B.M., lumber.
19	Schooner H. N. Kimball.....	182	do.....	111,000 feet, B.M., lumber.
20	Tug Warrior.....	44	San Pedro.....	None.
Mar. 2	Steamer San Mateo.....	1,926	Comax.....	4,150 tons coal.
12	Steamer Mineola.....	1,892	do.....	2,900 tons coal.
23	Steamer San Mateo.....	1,926	do.....	4,150 tons coal.
Apr. 2	Tug Warrior.....	44	San Pedro.....	None.
8	Steamer Wellington.....	1,267	Comax.....	2,400 tons coal.
16	Steamer San Mateo.....	1,926	do.....	4,300 tons coal.
26	Steamer Wellington.....	1,267	do.....	2,400 tons coal.
May 1	Steamer Scotia.....	132	Bowens Landing.....	6,680 ties.
17	Steamer Wellington.....	1,267	Dep. Bay.....	2,360 tons coal.
22	Steamer Sunol.....	194	Point Arena.....	8,415 ties.
23	Steamer San Mateo.....	1,926	Comax.....	4,300 tons coal.
26	Steamer Alcazar.....	202	Greenwood.....	8,423 ties.
29	Steamer Alcatraz.....	193	Point Arena.....	8,345 ties.
31	Steamer Protection.....	216	Bowens Landing.....	9,050 ties.
31	Steamer Sunol.....	194	Whitesboro.....	9,592 ties.
June 3	Steamer Wellington.....	1,267	Comax.....	2,400 tons coal.
12	Steamer Sunol.....	194	Point Arena.....	9,195 ties.
13	Steamer Protection.....	216	Bowens Landing.....	8,936 ties.
14	Steamer Alcazar.....	202	Point Arena.....	8,806 ties.
16	Steamer Alcatraz.....	1,926	Comax.....	4,300 tons coal.
16	Steamer Alcatraz.....	193	Point Arena.....	8,855 ties.
15	Steamer Albion.....	150	Albion.....	698 ties.
21	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
26	Steamer Alcatraz.....	193	Point Arena.....	8,436 ties.
28	Revenue cutter Oliver Wolcott.....	199	San Diego.....	None.
July 29	Steamer Sunol.....	194	Point Arena.....	8,640 ties.
4	Steamer Alcazar.....	202	do.....	None.
5	Schooner Bobolink.....	161	Mendocino.....	do.
6	Steamer Dawnmore.....	1,438	Payta, Peru.....	None.
20	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
27	Ship Glencairn.....	473	Tacoma.....	604,727 feet, B.M., lumber.
28	Steamer Alcazar.....	1,500	Antwerp (for Redondo).....	None.
29	Steamer Alcazar.....	202	Greenwood.....	9,221 ties.
31	Steamer Newaby.....	150	Bowens Landing.....	2,500 ties.
31	Steamer Alcatraz.....	193	Point Arena.....	8,560 ties.
Aug. 1	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
6	Steamer Protection.....	216	Bowens Landing.....	8,429 ties.
8	Steamer Sunol.....	194	Greenwood.....	10,105 ties.
14	Steamer San Mateo.....	1,926	Comax.....	4,300 tons coal.
23	Steamer Mineola.....	1,892	do.....	3,100 tons coal.
24	Steamer Sunol.....	194	Greenwood.....	9,341 ties.
25	Schooner Bobolink.....	161	Mendocino.....	85,459 feet, B.M., lumber.
26	Steamer Alcatraz.....	193	Point Arena.....	8,724 ties.
Sept. 1	Steamer San Mateo.....	1,926	Comax.....	4,300 tons coal.
4	Steamer Protection.....	216	Bowens Landing.....	8,688 ties.
4	Steamer Caspar.....	234	Caspar.....	350,479 feet, B.M., lumber.
4	Steamer Alcazar.....	202	Greenwood.....	4,619 ties.
7	Steamer Excelsior.....	364	Ventura.....	Passenger excursion.
8	Steamer Crown of England.....	1,657	Nanaimo.....	3,329 tons coal.
11	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
11	Steamer Sunol.....	194	Point Arena.....	8,427 ties.
13	Steamer Alcazar.....	202	do.....	8,784 ties.
17	Ship Elginshire.....	2,093	London.....	89 tons merchandise; 2,240 tons cement.
20	Steamer Sunol.....	194	Point Arena.....	9,941 ties.
21	Steamer San Mateo.....	1,926	Comax.....	4,300 tons coal.
23	Steamer Alcazar.....	202	Point Arena.....	9,120 ties.
26	Steamer Crown of England.....	1,657	Nanaimo.....	3,394 tons coal.

Freight vessels arriving at Port Los Angeles—Continued.

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1894.				
Sept. 26	Steamer Mincola.....	1,892	Comax.....	3,100 tons coal.
Oct. 4	Steamer Alcatraz.....	193	Greenwood.....	8,572 ties.
5	Steamer Sunol.....	194	Point Arena.....	8,160 ties.
6	Wrecker S. Pedro.....	100	Redondo.....	None.
7	Steamer Alcazar.....	202	Whitesboro.....	9,381 ties.
7	Steamer San Mateo.....	1,926	Comax.....	4,300 tons coal.
7	Steamer Alcatraz.....	193	Point Arena.....	8,961 ties.
13	Ship Jabez Howes.....	1,581	New York.....	1,645 tons merchandise; 878 tons coal.
14	Steamer Sunol.....	194	Point Arena.....	9,260 ties.
15	Schooner Bobolink.....	161	Mendocino.....	194,416 feet, B.M., lumber.
15	Steamer Tillamook.....	208	Bowens Landing.....	8,500 ties.
20	Steamer Alcazar.....	202	Whitesboro.....	8,000 ties.
25	Tug Warrior.....	44	San Pedro.....	None.
Nov. 1	Steamer Caspar.....	234	Caspar.....	42,611 feet, B.M., lumber.
2	Steamer Alcatraz.....	193	Point Arena.....	8,475 ties.
3	Steamer Rival.....	203	Fort Bragg.....	200,756 feet, B.M., lumber.
10	Steamer Sunol.....	194	Greenwood.....	8,533 ties.
13	Steamer Alcatraz.....	193	Point Arena.....	8,400 ties.
12	Tug Warrior.....	44	San Pedro.....	None.
17	do.....	44	do.....	Do.
18	Steamer Alcatraz.....	193	Point Arena.....	8,400 ties.
19	Tug Warrior.....	44	Santa Rosa Island.....	None.
20	Steamer Sunol.....	194	Greenwood.....	6,583 ties; 83,060 feet, B. M., lumber.
28	do.....	194	do.....	9,467 ties.
28	Steamer Alcatraz.....	193	Point Arena.....	8,400 ties.
Dec. 8	Steamer Mincola.....	1,892	Comax.....	3,000 tons coal.
9	Steamer Sunol.....	194	Whitesboro.....	8,100 ties.
9	Tug Collis.....	102	San Francisco.....	None.
10	Steamer Alcatraz.....	193	Greenwood.....	8,580 ties.
12	Steamer Jewel.....	202	Caspar.....	96,134 feet, B.M., lumber.
15	Steamer Mincola.....	1,892	Comax.....	3,000 tons coal.
19	Steamer Caspar.....	234	Mendocino.....	315,953 feet, B.M., lumber.
20	Steamer Alcazar.....	202	Whitesboro.....	8,377 ties.
21	Steamer San Mateo.....	1,926	Comax.....	4,100 tons coal.
29	Steamer Mincola.....	1,892	do.....	3,000 tons coal.
1895.				
Jan. 9	Steamer San Mateo.....	1,926	do.....	4,100 tons coal.
13	Steamer Mincola.....	1,892	Tacoma.....	3,000 tons coal.
16	Steamer Wellington.....	1,267	Comax.....	2,350 tons coal.
17	Schooner Reporter.....	333	Tacoma.....	419,000 feet, B.M., lumber.
29	Steamer Sunol.....	194	Fort Bragg.....	8,460 ties.
Feb. 7	Steamer San Mateo.....	1,926	Comax.....	4,100 tons coal.
11	Steamer Tillamook.....	208	Fort Bragg.....	1,500 ties.
11	Steamer Lakme.....	404	Noyo.....	18,000 ties.
12	Steamer P. Jensen.....	2,248	Nanaimo.....	4,332 tons coal.
12	Ship Port Stanley.....	2,187	Newcastle.....	3,450 tons coal.
12	Steamer Whitesboro.....	144	Greenwood.....	6,215 ties.
14	Steamer Newsboy.....	150	Noyo.....	5,941 ties; 30,000 feet, B. M., lumber.
21	Steamer Protection.....	216	Fort Bragg.....	8,752 ties.
25	Steamer San Mateo.....	1,926	Comax.....	4,100 tons coal.
25	Steamer Mincola.....	1,892	do.....	3,000 tons coal.
Mar. 1	Steamer Lakme.....	404	Fort Bragg.....	13,000 ties.
3	Steamer Sunol.....	194	Greenwood.....	28,700 feet, B.M., lumber; 8,521 ties.
6	Steamer Nat. City.....	220	Fort Bragg.....	5,137 ties.
9	Steamer Tillamook.....	208	Bowens Landing.....	8,000 ties.
11	Steamer Lakme.....	404	Fort Bragg.....	17,312 ties.
11	Steamer Protection.....	216	Udal.....	60,000 feet, B.M., lumber.
12	Steamer Sunol.....	194	Fort Bragg.....	7,462 ties.
13	Steamer San Mateo.....	1,926	Comax.....	4,100 tons coal.
14	Steamer Mincola.....	1,892	do.....	3,000 tons coal.
15	Steamer Greenwood.....	144	Greenwood.....	4,564 ties; 162 piles.
18	Steamer Tillamook.....	208	Bowens Landing.....	7,400 ties.
22	Steamer Sunol.....	194	Noyo.....	8,150 ties.
26	Steamer Greenwood.....	144	Greenwood.....	6,366 ties.
26	Steamer Westport.....	154	Fort Bragg.....	226 telegraph poles.
28	Steamer Newsboy.....	150	Albion.....	800 ties.
29	Steamer Lakme.....	404	Fort Bragg.....	15,000 ties.
30	Steamer San Mateo.....	1,926	Comax.....	4,100 tons coal.
Apr. 1	Steamer Alcatraz.....	193	Greenwood.....	8,665 ties.
2	Steamer Sunol.....	194	Point Arena.....	8,800 ties.
6	Steamer Greenwood.....	144	Fort Bragg.....	6,129 ties.
7	Steamer Alcazar.....	202	Greenwood.....	8,636 ties.
11	Steamer Sunol.....	194	Point Arena.....	9,615 ties.
11	Steamer Alcatraz.....	193	Westport.....	8,639 ties.
15	Steamer Jewel.....	202	Navarro.....	5,500 ties.

DEEP-WATER HARBOR.

305

Freight vessels arriving at Port Los Angeles—Continued.

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1895.				
Apr. 17	Steamer Tillamook	208	Bowens Landing	8,600 ties.
17	Steamer Alcazar	202	Newport	9,000 ties.
19	Steamer San Mateo	1,926	Comax	4,200 tons coal.
21	Steamer Greenwood	144	Bowens Landing	6,050 ties.
21	Steamer Whitesboro	144	Greenwood	4,604 ties; 55,753 feet, B. M., lumber.
23	Steamer Sunol	194	do	8,627 ties.
25	Steamer Jewel	202	Bowens Landing	9,255 ties.
25	Steamer P. Jebsen	2,248	Nanaimo	4,432 tons coal.
26	Steamer Lakme	404	Noyo	10,600 ties.
28	Steamer Alcazar	202	Newport	9,040 ties.
29	Steamer Greenwood	144	Greenwood	6,243 ties.
29	Steamer Protection	216	Usal	42,500 feet, B.M., lumber.
May 2	Schooner Seven Sisters	122	Biehlers Point	5,000 ties.
2	Schooner Elisa Miller	148	Navarro	5,809 ties.
3	Steamer Sunol	194	Greenwood	8,318 ties; 17,740 feet, B. M., lumber.
5	Steamer San Mateo	1,926	Comax	4,200 tons coal.
7	Steamer Alcazar	190	Westport	7,840 ties.
7	Steamer Alcazar	202	Greenwood	9,127 ties.
12	Steamer Mineola	1,892	Comax	3,150 tons coal.
13	Steamer Scotia	132	Bowens Landing	7,700 ties.
14	Steamer Alcazar	193	Cleone	8,810 ties.
17	Steamer Greenwood	144	Greenwood	2,502 ties; 28,008 feet, B. M., lumber.
17	Steamer Sunol	194	Point Arena	8,200 ties.
18	Steamer Alcazar	202	Cleone	9,160 ties.
19	Schooner Jos. Russ	235	Seattle	339,952 feet, B.M., lumber.
20	Steamer Nat. City	220	Eureka	220,796 feet, B. M., lumber.
23	Steamer Alcazar	193	Cleone	8,894 ties.
24	Steamer San Mateo	1,926	Comax	4,200 tons coal.
26	Steamer Sunol	194	Point Arena	9,600 ties.
31	Steamer Cleone	140	Isal	126,432 feet, B.M., lumber.
31	Steamer P. Jebsen	2,248	Nanaimo	4,460 tons coal.
31	Steamer Alcazar	202	Point Arena	6,400 ties; 60,000 feet, B. M., lumber.
June 24	Steamer Tillamook	208	San Pedro	Put in for coal.
2	Steamer Alcazar	193	Point Arena	8,389 ties.
2	Steamer Tillamook	208	Bowens Landing	9,050 ties.
3	Schooner Reporter	333	Tacoma	440,347 feet, B.M., lumber.
3	Steamer Sunol	194	Point Arena	8,409 ties.
3	Steamer Mineola	1,892	Comax	3,150 tons coal.
4	Steamer Alcazar	193	Whitesboro	74,069 feet, B.M., lumber.
4	Steamer Sunol	194	Point Arena	8,709 ties.
13	Steamer Nat. City	220	Eureka	110,000 feet, B.M., lumber.
13	Steamer San Mateo	1,926	Comax	4,200 tons coal.
14	Steamer Westport	154	Bear Harbor	8,490 ties.
17	Schooner E. Miller	148	Navarro	5,194 ties.
18	Steamer P. Jebsen	2,248	Nanaimo	4,470 tons coal.
18	Steamer Greenwood	144	Point Arena	6,340 ties.
21	Steamer Alcazar	202	Cleone	9,100 ties.
21	Steamer Alcazar	193	Point Arena	8,571 ties.
22	Steamer Sunol	194	do	8,488 ties.
28	Steamer Alcazar	202	do	8,502 ties.
30	Steamer Alcazar	193	Greenwood	7,154 ties; 72,317 feet, B. M., lumber.
30	Steamer Nat. City	220	Eureka	36,836 feet, B.M., lumber.
30	Steamer Sunol	194	Point Arena	8,598 ties.
July 3	Steamer Caspar	234	Newport	10,160 ties.
3	Schooner Seven Sisters	122	Phelps Landing	4,500 ties.
5	Steamer Jewel	202	Bowens Landing	9,450 ties.
8	Steamer Laguna	142	Bear Harbor	7,500 ties.
8	Steamer Sunol	194	Point Arena	8,720 ties.
8	Steamer Alcazar	193	Westport	9,260 ties.
9	Steamer Alcazar	202	Cleone	8,800 ties.
11	Steamer Westport	154	Bear Harbor	8,850 ties.
13	Steamer Rival	203	Fort Bragg	9,767 ties.
14	Steamer Greenwood	144	Point Arena	6,245 ties.
16	Steamer Whitesboro	144	do	6,200 ties.
16	Steamer Protection	216	Westport	9,330 ties.
16	Steamer Alcazar	202	Cleone	8,671 ties.
19	Steamer Nat. City	220	Eureka	27,758 feet, B.M., lumber.
20	Steamer Alcazar	193	Point Arena	8,700 ties.
23	Steamer Sunol	194	Greenwood	4,844 ties; 150,031 feet, B. M., lumber.
24	Steamer Alcazar	202	Point Arena	8,800 ties.
26	Steamer Jewel	202	Bowens Landing	9,500 ties.
27	Steamer Caspar	234	Newport	10,200 ties.
29	Steamer Alcazar	193	Point Arena	9,125 ties.
31	Steamer Sunol	194	Whitesboro	9,100 ties.

Freight vessels arriving at Port Los Angeles—Continued.

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1896.				
July 13	Steamer Caspar.....	224	Caspar.....	Put in for telegram.
Aug. 3	Steamer Alcatraz.....	202	Cleone.....	9,579 ties.
	Ship Eclipse.....	1,536	New York.....	347 tons coal; 1,063 tons merchandise.
7	Steamer Westport.....	154	Needle Rock.....	4,552 ties.
9	Steamer Caspar.....	224	Noyo.....	9,731 ties; 29,634 feet, B. M., lumber.
10	Steamer Sunol.....	194	Whiteboro.....	9,000 ties.
11	Steamer Laguna.....	142	Bear Harbor.....	3,300 ties.
11	Steamer Alcatraz.....	193	Point Arena.....	5,725 ties.
12	Ship Fingal.....	2,435	Newcastle.....	3,935 tons coal.
12	Steamer Whiteboro.....	144	Point Arena.....	1,343 ties.
13	Ship Lady Isabella.....	1,462	Hamburg.....	1,854 tons cement.
14	Steamer Alcatraz.....	202	Needle Rock.....	10,622 ties.
20	Steamer Cleone.....	140	Westport.....	7,300 ties.
20	Steamer Alcatraz.....	193	Point Arena.....	8,000 ties.
21	Steamer Sunol.....	194	Greenwood.....	5,500 ties; 120,000 feet, B. M., lumber.
29	Schooner Seven Sisters.....	122	Biehlers Point.....	4,500 ties.
24	Steamer Alcatraz.....	202	Cleone.....	9,130 ties.
30	Steamer Jewel.....	202	Bowens Landing.....	2,375 ties.
30	Steamer Sunol.....	194	Greenwood.....	2,423 ties; 30,126 feet, B. M., lumber.
31	Steamer Alcatraz.....	193	Needle Rock.....	10,000 ties.
18	Schooner E. Claudena.....	185	Vancouver.....	To enter custom-house.
Sept. 9	Steamer Sunol.....	194	Redondo.....	8,080 ties.
9	Steamer Mincola.....	1,892	Comax.....	3,200 tons coal.
12	Steamer Alcatraz.....	193	Needle Rock.....	9,900 ties.
24	Schooner G. W. Watson.....	430	Tacoma.....	584,196 feet, B. M., lumber.
24	Steamer Mincola.....	1,892	Comax.....	3,200 tons coal.
29	Steamer Alcatraz.....	193	Greenwood.....	163,541 feet, B. M., lumber; 4,300 ties.
Oct. 26	Tug Colla.....	102	San Francisco.....	None.
3	Steamer So. Coast.....	300	Trinidad.....	40,000 feet, B. M., lumber.
3	Steamer Mincola.....	1,892	Comax.....	3,200 tons coal.
9	Steamer P. Jacobsen.....	2,348	Nanaimo.....	4,499 tons coal.
11	Steamer Excelsior.....	364	Eureka.....	155,000 feet, B. M., lumber.
14	Steamer San Mateo.....	1,926	Comax.....	4,200 tons coal.
21	Steamer Alcatraz.....	193	Point Arena.....	8,410 ties.
22	Schooner Premier.....	292	Tacoma.....	430,677 feet, B. M., lumber.
30	Steamer San Mateo.....	1,926	Comax.....	4,200 tons coal.
Nov. 3	Schooner N. Sundborg.....	62	Stewart Point.....	2,430 ties.
17	Steamer San Mateo.....	1,926	Comax.....	4,050 tons coal.
13	Bark E. Talbot.....	1,193	Vancouver.....	527,384 feet, B. M., lumber.
14	Bark Edinburghshire.....	1,277	London.....	448 tons merchandise; 1,120 tons cement.
9	Ship Eaton Hall.....	1,779	do.....	861 tons merchandise; 1,144 tons cement.
19	Steamer Alcatraz.....	202	Greenwood.....	106,000 feet, B. M., lumber.
22	Bark Forfarshire.....	1,300	Antwerp.....	192 tons merchandise; 800 tons cement.
2	Steamer Mincola.....	1,892	Comax.....	3,200 tons coal.
	Steamer Jewel.....	202	Newport.....	For coal.
	Steamer yacht Eleanor.....	250	San Diego (tour around world).	
Dec. 4	Steamer Mincola.....	1,892	Comax.....	3,100 tons coal.
7	Steamer San Mateo.....	1,926	do.....	4,050 tons coal.
8	Schooner O. M. Kellogg.....	373	Graves Harbor.....	479,093 feet, B. M., lumber.
10	Ship Point Elgin.....	1,622	Newcastle.....	2,604 tons coal.
14	Steamer Sunol.....	194	Point Arena.....	8,150 ties.
16	Steamer Newbery.....	150	Udal.....	120,872 feet, B. M., lumber.
24	Steamer San Mateo.....	1,926	Comax.....	4,050 tons coal.
26	Steamer Alcatraz.....	193	Point Arena.....	92,263 feet, B. M., lumber; 6,450 ties.
24	Steamer Alcatraz.....	202	Newport.....	For coal.
12	Tug Warrior.....	44	San Pedro.....	None.
1896.				
Jan. 3	Steamer Progressalist.....	2,025	Comax.....	3,700 tons coal.
5	Steamer Alcatraz.....	193	Point Arena.....	8,500 ties.
8	Steamer Excelsior.....	364	Eureka.....	149,817 feet, B. M., lumber.
11	Steamer P. Jacobsen.....	2,348	Nanaimo.....	4,287 tons coal.
12	Ship Airila.....	1,892	Antwerp.....	380 tons merchandise; 150 tons coke, 903 tons cement.
13	Steamer City of Everett.....	1,858	Panama.....	No freight.
13	Steamer San Mateo.....	1,926	Comax.....	4,050 tons coal.
14	Steamer Alcatraz.....	202	Point Arena.....	8,240 ties.

a About.

Freight vessels arriving at Port Los Angeles—Continued.

Date.	Name of vessel.	Registered tonnage.	From the port of—	Cargo.
1896.				
Jan. 10	Steamer Progress.....	1,445	Comax.....	2,450 tons coal.
25	Steamer Alcazar.....	202	Greenwood.....	4,025 ties; 155,173 feet, B. M., lumber.
27	Steamer Progressist.....	2,025	.....	3,700 tons coal.
28	Steamer Excelsior.....	354	.....	50,112 feet, B. M., lumber.
29	Steamer Mineola.....	1,892	Comax.....	3,108 tons coal.
30	Steamer Scotia.....	152	Albion.....	63,162 feet, B. M., lumber.
Feb. 4	Steamer San Mateo.....	1,926	Comax.....	4,050 tons coal.
16	Ship St. John.....	1,826	New York.....	1,484 tons coal; 1,483 tons merchandise.
16	Ship Dunboyne.....	1,380	London.....	1,973 tons cement.
20	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
25	Steamer San Mateo.....	1,926	do.....	4,050 tons coal.
28	Steamer Nat. City.....	220	Eureka.....	37,668 feet, B. M., lumber.
29	Steamer Colon.....	1,843	Panama.....	No freight.
Mar. 3	Steamer Mineola.....	1,892	Comax.....	3,050 tons coal.
3	Ship Philadelphia.....	1,709	Hamburg.....	11 tons merchandise;
				3,000 tons cement.
13	Steamer Newaby.....	150	Usal.....	145,672 feet, B. M., lumber.
13	Steamer San Mateo.....	1,926	Comax.....	4,050 tons coal.
26	Bark Fernbank.....	1,338	Antwerp.....	613 tons merchandise;
				848 tons cement.
30	Schooner Seven Sisters.....	123	Bowens Landing.....	2,010 ties.
Apr. 20	Steamer Sacramento.....	124	Albion.....	5,364 ties.
6	Steamer Protection.....	216	Bowens Landing.....	9,200 ties; 146 tie poles.
13	Steamer Mineola.....	1,892	Comax.....	3,100 tons coal.
23	Ship C. E. Moody.....	1,915	New York.....	1,595 tons merchandise.
				1,372 tons coal, 159 tons coke.
29	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,432 tons coal.
May 10	Steamer San Mateo.....	1,926	Comax.....	4,200 tons coal.
15	Steamer Alcazar.....	202	Greenwood.....	105,466 feet, B. M., lumber.
18	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,348 tons coal.
19	Steamer Westport.....	154	Bear Harbor.....	7,440 ties.
30	Steamer Protection.....	216	Usal.....	77,701 feet, B. M., lumber.
June 5	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,367 tons coal.
9	Steamer Westport.....	154	Bear Harbor.....	6,960 ties.
14	Ship Dunayro.....	2,056	Newcastle.....	3,340 tons coal.
22	Steamer Alcazar.....	202	Greenwood.....	65,602 feet, B. M., lumber.
23	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,421 tons coal.
26	Steamer Newaby.....	150	Usal.....	60,887 feet, B. M., lumber.
July 2	Steamer Alcazar.....	202	Greenwood.....	47,152 feet, B. M., lumber.
6	Steamer Westport.....	154	Bear Harbor.....	7,920 ties.
12	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,415 tons coal.
15	Schooner Alice.....	220	Fills Landing.....	235,243 feet, B. M., lumber.
25	Steamer Protection.....	216	Usal.....	192,111 feet, B. M., lumber.
26	Steamer Lakmo.....	404	Tacoma.....	573,014 feet, B. M., lumber.
29	Bark Gulf Stream.....	1,378	Antwerp.....	823 tons cement; 266 tons merchandise.
Aug. 3	Schooner Reporter.....	333	Everett.....	552,000 feet, B. M., lumber.
4	Ship Drumliff.....	2,469	London.....	228 tons coke, 1,175 tons cement, 531 tons merchandise.
11	Bark Artemis.....	1,407	Hamburg.....	1,246 tons cement; 4 tons merchandise.
18	Steamer Protection.....	216	Usal.....	57,481 feet, B. M., lumber.
24	Steamer Alcazar.....	202	Greenwood.....	258,067 feet, B. M., lumber.
Sept. 10	Steamer Mineola.....	1,892	Comax.....	3,206 tons coal.
24	Steamer Mineola.....	1,892	do.....	3,200 tons coal.
29	Steamer Protection.....	216	Usal via Redondo.....	128,471 feet, B. M., lumber.
Oct. 9	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,435 tons coal.
16	Steamer Nat. City.....	220	Eureka.....	74,610 feet, B. M., lumber.
20	Steamer Mineola.....	1,892	Comax.....	3,150 tons coal.
25	Steamer P. Jepsen.....	2,348	Nanaimo.....	4,467 tons coal.
Nov. 2	Steamer Washetman.....	2,004	Comax.....	4,100 tons coal.
6	Steamer Mineola.....	1,892	do.....	3,150 tons coal.
21	Steamer Newaby.....	150	Hardy Creek.....	3,064 ties.
25	Steamer Mineola.....	1,892	Comax.....	3,050 tons coal.
26	Schooner Ethel Lane.....	473	Port Gambie.....	100,000 feet, B. M., lumber.
Dec. 10	Port Crawford.....	1,560	Hamburg.....	2,386 tons cement.
	J. C. Goss.....	1,524	.....	50 tons iron.

RECAPITULATION.

May 9 to Dec. 31, 1893:		
Coal	.....	tons.. 35,307
Ties	.....	272,387
Lumber	.....	feet, B. M.. 990,853
New York and foreign vessels—		
1 steamer from New York—		
Rails	.....	tons.. 700
Merchandise	.....	500
1 bark from Liverpool, merchandise	.....	do.. 1,200
Jan. 1 to Dec. 31, 1894:		
Coal	.....	do.. 66,333
Ties	.....	354,179
Lumber	.....	feet, B. M.. 2,358,508
New York and foreign vessels—		
1 ship from London—		
Merchandise	.....	tons.. 89
Cement	.....	do.. 2,240
1 ship from New York—		
Merchandise	.....	do.. 1,645
Coal	.....	do.. 878
Jan. 1 to Dec. 31, 1895:		
Coal	.....	do.. 117,102
Ties	.....	650,180
Lumber	.....	feet, B. M.. 5,491,147
Piles	.....	183
Telegraph poles	.....	236
New York and foreign vessels—		
3 ships from Newcastle, coal	.....	tons.. 10,088
1 ship from New York—		
Coal	.....	do.. 347
Merchandise	.....	do.. 1,963
1 ship from Hamburg, cement	.....	do.. 1,854
1 bark from Antwerp—		
Merchandise	.....	do.. 192
Cement	.....	do.. 800
1 bark from London—		
Merchandise	.....	do.. 448
Cement	.....	do.. 1,120
1 ship from London—		
Merchandise	.....	do.. 661
Cement	.....	do.. 1,144

EXHIBIT No. 6.

LOS ANGELES, CAL., December 17, 1896.

DEAR SIR: Inclosed please find a statement of Los Angeles tonnage, both north and south bound, handled at the different ports for twelve months ending August 31, 1896.

You will notice that there are four wharves at which Los Angeles freight, in connection with the Pacific Coast Steamship Company, is handled—Port Los Angeles, San Pedro, East San Pedro, and Redondo—and that of the total tonnage, 65,758,310 pounds, there was handled at Port Los Angeles 32,415,615 pounds, or, say, 49.3 per cent of all, as against 13.3 per cent handled at San Pedro and East San Pedro and 37.4 per cent handled at Redondo.

This illustrates forcibly, I think, the value that the merchants place on Port Los Angeles, for they forward and receive via that port as much as they forward and receive by the way of San Pedro, East San Pedro, and Redondo.

The figures set forth in this letter can be relied upon, as they are gathered from the waybills of each road operating between Los Angeles and the ports named. Of course there is additional freight, which comes down by steamer for the interior, but that is a small amount comparatively, and cuts but little figure in the total tonnage.

My object is to show you the value that the merchants even now place on Port Los Angeles as against the other ports, both in the saving of time and proper facilities for handling.

I refer to what you probably know, i. e., that the large steamers of the Pacific Coast Steamship Company, like the *Corona* and *Santa Rosa*, stop only at Port Los Angeles and Redondo, while the small steamers only, like the *Eureka* and *Bonita*, stop at East San Pedro and San Pedro.

Yours, truly,

JNO. M. CRAWLEY.

Mr. WM. HOOD (care Nadeau Hotel, City).

DEEP-WATER HARBOR.

309

Los Angeles and ocean traffic September 1, 1895, to August 31, 1896.

NORTH AND SOUTH BOUND.

	Pounds.	Per cent.
Port Los Angeles.....	32,415,615	49.3
San Pedro.....	3,039,850	4.6
East San Pedro.....	5,680,738	8.7
Southern California Railway.....	11,789,507	17.9
Redondo Railway.....	12,632,600	19.5
Total.....	65,758,310	
<i>Each port.</i>		
Port Los Angeles.....	32,415,615	49.3
San Pedro.....	5,720,588	13.3
East San Pedro.....	24,622,107	37.4
Redondo.....		
<i>Each company.</i>		
Port Los Angeles.....	35,455,465	53.9
San Pedro.....	5,680,738	8.7
East San Pedro.....	11,789,507	17.9
Southern California Railway.....	12,632,600	19.5
Redondo Railway.....		

	North bound.		South bound.	
	Pounds.	Per cent.	Pounds.	Per cent.
Port Los Angeles.....	2,383,050	43.5	20,032,505	49.3
San Pedro.....	741,890	13.6	2,297,900	3.3
East San Pedro.....	528,290	9.6	5,154,448	9.6
Southern California Railway.....	1,573,818	28.7	10,215,689	16.9
Redondo Railway.....	251,542	4.6	12,581,058	20.9
Total.....	5,478,590		60,281,720	
<i>Each port.</i>				
Port Los Angeles.....		43.5		49.3
San Pedro.....		23.2		12.4
East San Pedro.....		33.3		37.3
Redondo.....				
<i>Each company.</i>				
Port Los Angeles.....		57.1		53.6
San Pedro.....		9.6		8.6
East San Pedro.....		28.7		16.9
Southern California Railway.....		4.6		20.9
Redondo Railway.....				

EXHIBIT No. 7.

OFFICE GENERAL FREIGHT AGENT.

SAN FRANCISCO, CAL., December 5, 1896.

DEAR SIR: In compliance with your memorandum of the 25th ultimo, calling for deep-sea tonnage, with names of deep-sea vessels, and local tonnage shown separately, passing Port Los Angeles, compared with San Pedro, for last twelve months, estimating tonnage handled by terminal road, inclosed please find original, with five additional copies each, as follows:

(1) Tonnage passing Port Los Angeles July 1, 1895, to June 30, 1896, inclusive, discharged from deep-sea vessels, from local coast vessels; delivered to deep-sea vessels, local coast vessels; names of deep-sea vessels; number of vessels landing—deep-sea, local coast, lumber. (Figures used in this statement as to tonnage received and delivered from deep-sea craft obtained from agent, Port Los Angeles; other tonnage obtained from records furnished by freight auditor.)

(2) Tonnage passing San Pedro (inner harbor) July 1, 1895, to June 30, 1896, inclusive, discharged from local coast vessels; delivered to local coast vessels; showing tonnage carried by Southern Pacific Company and Terminal Railway. Some of the lumber was carried jointly by Terminal Railway and Southern California Railway. We are unable to segregate, as between these two carriers, the quantity carried by each. Have therefore shown lump sum carried by both; number of

vessels landing, local coast and lumber. (Figures used here furnished by A. G. F. A. Crawley from data taken from records of the station.)

(3) Port Los Angeles versus San Pedro (inner harbor) July 1, 1895, to June 30, 1896, inclusive, compared. (Figures here used obtained from same source as shown above, Nos. 1 and 2.)

(4) Tonnage passing Port Los Angeles by commodities July 1, 1895, to June 30, 1896, inclusive. (Figures here used furnished by freight auditor.)

(5) Merchandise, except lumber, passing San Pedro July 1, 1895, to June 30, 1896, inclusive, showing date calling, number of vessels, tons received or discharged. (This data furnished by A. G. F. A. Crawley, taken from the records of San Pedro station.)

(6) Lumber passing San Pedro (inner harbor) July 1, 1895, to June 30, 1896, showing date of calling, names of vessels, tons discharged or received. (These figures, also furnished by A. G. F. and P. A. Crawley, taken from station records.)

Have used the period ending June 30, 1896, because this is as late as we can get the data for within the time prescribed.

During this period there was no tonnage discharged from or delivered to vessels at San Pedro outer harbor.

Yours, truly,

Mr. J. C. STUBBS,

Third Vice-President, Southern Pacific Company Building.

C. F. SMURR.

Merchandise, except lumber, passing San Pedro (inner harbor) July 1, 1895, to June 30, 1896, inclusive.

DISCHARGED FROM COAST VESSELS.

Date.	Vessel.	Tons.	Date.	Vessel.	Tons.
1895.			1895.		
July 2	Steamer St. Paul	40	Nov. 23	Steamer St. Paul	138
6	Steamer Eureka	40	27	Steamer Eureka	43
10	Steamer St. Paul	65	Dec. 1	Steamer St. Paul	84
14	Steamer Eureka	40	4	Steamer Santa Cruz	45
17	Steamer Santa Cruz	10	5	Steamer Eureka	56
18	Steamer St. Paul	95	9	Steamer St. Paul	28
22	Steamer Eureka	91	13	Steamer Eureka	21
26	Steamer St. Paul	35	17	Steamer St. Paul	28
30	Steamer Eureka	57	21	Steamer Eureka	21
Aug. 3	Steamer St. Paul	62	25	Steamer St. Paul	17
7	Steamer Eureka	51	29	Steamer Eureka	64
11	Steamer St. Paul	44			
15	Steamer Eureka	43	1896.		
19	Steamer St. Paul	85	Jan. 2	Steamer St. Paul	39
23	Steamer Eureka	30	5	Steamer Eureka	99
27	Steamer St. Paul	38	10	Steamer St. Paul	68
31	Steamer Eureka	46	14	Steamer Eureka	27
Sept. 4	Steamer St. Paul	34	17	Steamer Santa Cruz	59
8	Steamer Eureka	32	19	Steamer St. Paul	46
12	Steamer St. Paul	47	22	Steamer Eureka	114
16	Steamer Eureka	32	23	Bark Ferris S. Thompson	616
19	Schooner Penelope	5	26	Schooner Annie	200
20	Steamer St. Paul	34	26	Steamer St. Paul	113
22	Steamer Bonita	40	29	Steamer Coos Bay	29
24	Steamer Eureka	46	Feb. 3	Steamer St. Paul	53
25	Schooner Serena Thayer	216	7	Steamer Eureka	43
28	Schooner Vina	288	9	Schooner Bonita	25
28	Steamer St. Paul	73	10	Steamer St. Paul	66
Oct. 2	Steamer Eureka	83	16	Steamer Eureka	108
15	Steamer St. Paul	168	19	Steamer St. Paul	84
6	Steamer St. Paul	128	23	Steamer Eureka	87
10	Steamer Eureka	130	27	Steamer St. Paul	40
17	Steamer Bonita	239	Mar. 3	Steamer Eureka	31
2	Schooner Norma	630	6	Steamer St. Paul	65
26	Steamer Eureka	24	9	Steamer Bonita	13
27	Steamer Santa Cruz	322	10	Steamer Eureka	96
18	Steamer Eureka	135	14	Steamer Lakme	218
22	Steamer St. Paul	119	14	Steamer St. Paul	30
23	Steamer Santa Cruz	6	18	Steamer Eureka	52
30	Steamer St. Paul	49	22	Steamer St. Paul	45
Nov. 1	Steamer Bonita	48	26	Steamer Eureka	44
3	Steamer Eureka	76	30	Steamer St. Paul	59
5	Bark Ferris S. Thompson	50	Apr. 3	Steamer Eureka	4
6	Steamer Santa Cruz	230	7	Steamer Bonita	66
7	Steamer St. Paul	36	11	Steamer Eureka	56
11	Steamer Eureka	36	15	Steamer St. Paul	19
15	Steamer St. Paul	99	19	Steamer Eureka	83
18	Steamer Santa Cruz	80	23	Steamer St. Paul	123
19	Steamer Eureka	100	27	Steamer Eureka	49

Merchandise, except lumber, passing San Pedro (inner harbor) July 1, 1895, etc.—Cont'd.

DISCHARGED FROM COAST VESSELS—Continued.

Date.	Vessel.	Tons.	Date.	Vessel.	Tons.
1895.			1895.		
Apr. 27	Steamer Bonita	13	June 2	Steamer St. Paul	36
May 1	Steamer St. Paul	128	4	Steamer Bonita	49
3	Steamer Eureka	63	6	Steamer Eureka	61
9	Steamer St. Paul	129	10	Steamer St. Paul	37
13	Steamer Eureka	55	15	Steamer Eureka	39
18	Schooner Penelope	6	18	Steamer St. Paul	71
15	Steamer Santa Cruz	5	22	Steamer Eureka	60
17	Steamer St. Paul	67	27	Steamer St. Paul	64
21	Steamer Eureka	58			
25	Steamer St. Paul	27			
29	Steamer Eureka	15		Total	9,163

DELIVERED TO LOCAL COAST VESSELS.

1895.			1895.		
July 2	Steamer St. Paul	7	Jan. 7	Steamer Eureka	77
6	Steamer Eureka	37	11	Steamer St. Paul	17
11	Steamer St. Paul	6	15	Steamer Eureka	5
15	Steamer Eureka	10	19	Steamer St. Paul	6
19	Steamer St. Paul	8	23	Steamer Eureka	10
22	Steamer Eureka	10	27	Schooner Annie	101
27	Steamer St. Paul	11	27	Steamer St. Paul	101
31	Steamer Eureka	6	31	Steamer Coos Bay	70
Aug. 4	Steamer St. Paul	7	Feb. 4	Steamer St. Paul	23
8	Steamer Eureka	7	8	Steamer Eureka	23
12	Steamer St. Paul	35	12	do	198
16	Steamer Eureka	6	20	Steamer St. Paul	95
20	Steamer St. Paul	6	23	Steamer Eureka	95
24	Steamer Eureka	12	26	Steamer St. Paul	7
28	Steamer St. Paul	4	Mar. 2	Bark Enoch Talbot	1,135
Sept. 1	Steamer Eureka	50	3	Steamer Eureka	3
5	Steamer St. Paul	10	7	Steamer St. Paul	230
7	Steamer Bonita	28	11	Steamer Pasadena	53
9	Steamer Eureka	3	15	Steamer St. Paul	4
13	Steamer St. Paul	19	23	do	198
17	Steamer Eureka	28	27	Steamer Eureka	11
21	Steamer St. Paul	22	11	do	3
25	Steamer Eureka	4	19	do	165
29	Steamer St. Paul	7	30	Steamer St. Paul	10
Oct. 3	Steamer Eureka	18	Apr. 4	Steamer Eureka	95
7	Steamer St. Paul	4	8	Steamer St. Paul	5
11	Steamer Eureka	42	12	Steamer Eureka	130
15	Steamer St. Paul	19	16	Steamer St. Paul	111
19	Steamer Eureka	204	19	Steamer Eureka	113
23	Steamer St. Paul	59	24	Steamer St. Paul	486
31	do	35	28	Steamer Eureka	110
27	Steamer Eureka	6	May 1	Steamer St. Paul	194
Nov. 8	Steamer St. Paul	13	6	Steamer Eureka	9
12	Steamer Eureka	6	10	Steamer St. Paul	37
16	Steamer St. Paul	3	14	Steamer Eureka	10
24	do	105	18	Steamer St. Paul	39
28	Steamer Eureka	1	21	Steamer Eureka	20
20	do	8	26	Steamer St. Paul	4
Dec. 2	Steamer St. Paul	35	June 1	Steamer Eureka	29
7	Steamer Eureka	20	5	Steamer St. Paul	20
10	Steamer St. Paul	9	12	do	4
14	Steamer Eureka	82	13	Steamer Eureka	4
18	Steamer St. Paul	7	30	Steamer St. Paul	5
22	Steamer Eureka	22	30	Steamer Eureka	5
26	Steamer St. Paul	56	28	Steamer St. Paul	13
30	Steamer Eureka	4			
1895.				Total	4,951
Jan. 3	Steamer St. Paul	2			

RECAPITULATION.

Discharged from coast vessels	9,163
Delivered to local coast vessels	4,951
Total	14,113
Handled by—	
Southern Pacific Company	10,264
Los Angeles Terminal Company	3,849
Total	14,113

DEEP-WATER HARBOR.

Lumber passing San Pedro (inner harbor), July 1, 1895, to June 30, 1896.

DISCHARGED FROM COAST LUMBER CRAFT.

Date.	Vessel.	Tons.	Date.	Vessel.	Tons.
1895.			1895.		
July 1	Brig Courtney Ford	733	Sept. 22	Schooner Peerless	538
1	Schooner Lucy	608	23	Schooner Mabel Gray	375
3	Schooner C. A. Holmes	1,000	25	Schooner J. M. Colman	942
3	Schooner Barbara Hemster	291	25	Bark Tidal Wave	1,042
4	Schooner Prosper	1,541	25	Schooner Serena Thayer	238
4	Schooner Bangor	959	26	Schooner Vina	225
4	Schooner Peerless	544	28	Steamer Pasadena	458
7	Schooner J. B. Leeds	450	30	Steamer Jewel	550
10	Schooner Barkentine Skagit	1,050	Oct. 3	Schooner Lucy	602
14	Schooner Meteor	1,417	4	Schooner Excelaior	716
14	Schooner Bertha Dolber	475	5	Schooner Kellogg	833
14	Schooner Tillamook	467	7	Steamer Excelaior	523
15	Schooner Alice	457	8	Schooner Maid of Orleans	333
18	Steamer Newsboy	88	8	Barkentine Planter	1,033
18	Schooner Newark	275	9	Schooner Comet	833
19	Schooner Una	472	12	Steamer Pasadena	500
19	Schooner C. E. Falk	648	12	Steamer Tillamook	481
19	Schooner Jessie Minor	625	4	Schooner Antelope	370
23	Steamer Westport	487	6	Schooner San Buenaventura	463
26	Steamer Excelaior	738	24	Schooner Annie	358
26	Steamer Letitia	417	25	Schooner Skagit	1,063
27	Steamer Serena Thayer	458	26	Schooner Excelaior	291
28	Steamer Tillamook	467	16	Schooner W. F. Jewett	1,083
28	Steamer National City	333	17	Schooner Monterey	291
28	Steamer Pasadena	450	17	Schooner Jessie Minor	458
30	Schooner Barbara Hemster	283	17	Schooner Annie Larsen	666
Aug. 1	Schooner Louisa	700	23	Steamer Jewel	550
2	Schooner Comet	833	23	Schooner Reporter	445
3	Schooner Tallant	1,300	23	Schooner Salvator	733
6	Barkentine Monitor	643	29	Steamer Pasadena	916
8	Steamer Jewel	500	29	Schooner El Norah	458
9	Steamer J. W. Weatherwax	834	30	Schooner Holmes	450
11	Steamer Pasadena	466	31	Schooner Lillie Bonne	1,000
11	Schooner Gironde	450	31	Barkentine Monitor	533
11	Schooner Reporter	732	31	Steamer Mabel Gray	383
11	Schooner Lizzie Vance	858	Nov. 3	Steamer Marie Smith	750
11	Steamer Protection	333	3	Steamer Bartlett	1,033
11	Steamer National City	83	3	Barkentine J. M. Griffith	633
11	Barkentine Uncle John	760	3	Schooner Louise	683
11	Schooner M. C. Ross	550	3	Schooner Redfield	1,133
13	Steamer Tillamook	466	6	Steamer Excelaior	250
13	Schooner Jewel	1,000	7	Schooner Serena Thayer	450
13	Schooner E. Norah	417	9	Schooner Bangor	1,000
14	Schooner Allen A.	708	11	Steamer Laguna	400
15	Schooner Glendale	592	11	Steamer Protection	450
18	Schooner Lucy	633	12	Steamer Pasadena	500
18	Steamer Newsboy	133	12	Schooner Sadie	612
22	Schooner Salvator	900	13	Schooner Meteor	525
25	Steamer Caspar	433	13	Schooner Ethel Zoane	1,000
28	Steamer National City	333	18	Brig Tanner	877
28	Schooner M. C. Ross	558	13	Schooner Nokomis	1,167
29	Steamer Pasadena	458	15	Schooner Corona	833
29	Schooner Alice	450	21	Steamer Alcatraz	532
31	Steamer Westport	475	22	Barkentine Chikitat	1,075
Sept. 1	Schooner C. S. Holmes	1,000	23	Steamer Tillamook	545
1	Schooner Newark	66	23	Steamer Alcatraz	670
1	Schooner Bartlett	1,100	24	Steamer G. W. Watson	962
4	Barkentine Skagit	1,028	24	Steamer Lucie	608
5	Barkentine J. M. Griffith	1,217	26	Steamer Ivy	333
6	Schooner Nokomis	1,125	26	Steamer Excelaior	392
6	Brig Tanner	500	28	Steamer Pasadena	520
10	Steamer Pasadena	458	28	Schooner J. M. Coleman	958
10	Steamer Alcatraz	604	29	Steamer Jewel	542
11	Schooner Witman	912	30	Bark Tidal Wave	1,000
11	Schooner C. E. Falk	686	30	Steamer Alcatraz	611
11	Schooner Una	488	Dec. 5	Schooner El Norah	521
13	Steamer Newsboy	225	6	Steamer Protection	66
15	Steamer Jewel	583	9	Schooner Norma	750
16	Schooner Annie	353	10	Steamer Tillamook	448
17	Schooner Louise	716	10	Steamer Excelaior	500
18	Steamer Tillamook	475	10	Steamer Pasadena	500
18	Schooner Letitia	400	10	Schooner Prosper	1,397
32	Schooner Meteor	1,266	13	Schooner Barbara Hemster	292
32	Schooner Prosper	1,492	13	Brig Geneva	1,050
32	Steamer Excelaior	42	13	Brig Enoch Talbot	50
32	Schooner Ruby A. Cousins	383	15	Steamer Alcatraz	292
				Schooner Comet	817

DEEP-WATER HARBOR.

313

Lumber passing San Pedro (inner harbor), July 1, 1895, to June 30, 1896—Continued.

DISCHARGED FROM COAST LUMBER CRAFT—Continued.

Date.	Vessel.	Tons.	Date.	Vessel.	Tons.
1895.			1896.		
Dec. 16	Schooner H. C. Wright	666	Mar. 14	Schooner Dora Blenner	666
16	Schooner Queen	558	14	Steamer Lakme	833
16	Schooner Alice	450	15	Schooner El Norah	450
16	Schooner Birdie Minor	533	15	Schooner Sadie	625
16	Bark Retriever	1,083	18	Steamer National City	583
16	Bark Monitor	643	23	Schooner Peerless	558
16	Steamer Lakme	766	25	Steamer Pasadena	500
24	Schooner Serena Thayer	450	25	Steamer Tillamook	521
26	Schooner Annie Larsen	766	26	Steamer Navarro	266
25	Steamer Excelsior	933	26	Schooner Meteor	1,266
25	Steamer Pasadena	500	28	Schooner Bangor	1,000
25	Steamer Tillamook	464	28	Schooner C. A. Thayer	950
25	Schooner Louise	700	30	Schooner Louise	671
25	Schooner Sadie	575	30	Schooner E. Woder	573
25	Bark Katie Fickenger	966	31	Schooner Comet	766
27	Schooner Salvator	916	31	Bark Tidal Wave	1,000
28	Steamer Jewel	511	31	Schooner Mary E. Russ	418
28	Schooner S. C. Holmes	1,000	Apr. 3	Schooner Corona	883
28	Schooner Reporter	708	6	Steamer Caspar	563
28	Schooner Premier	700	7	Schooner C. S. Holmes	954
1896.			7	Steamer National City	363
Jan. 3	Schooner Bartlett	1,017	11	Steamer Tillamook	483
8	Schooner Lottie Carson	542	13	Schooner Serena Thayer	492
8	Schooner El Norah	464	13	Schooner J. M. Weatherwax	833
8	Steamer Pasadena	512	16	Steamer Alcatraz	533
10	Steamer Excelsior	266	16	Ollie Ford	508
11	Steamer Tillamook	471	19	Barkentine Monitor	411
13	Steamer Lakme	1,000	20	Steamer Pasadena	500
14	Steamer National City	533	20	Schooner Alice	450
21	Schooner Nokomis	1,083	22	Schooner Huene	733
21	Schooner Meteor	1,275	22	Schooner Una	450
22	Schooner Lucy	583	22	Schooner Sadie	617
23	Steamer Pasadena	500	28	Steamer Monterey	245
23	Schooner Bangor	916	28	Schooner El Norah	283
23	Bark Ferris S. Thompson	200	29	Schooner Occidental	400
24	Schooner Vesta	591	May 2	Schooner Azalea	750
24	Brig Tanner	500	3	Schooner C. E. Falk	650
24	Steamer Navarro	83	3	Steamer Jewel	508
25	Schooner Edw. Parko	467	13	Steamer Alcasar	333
25	Schooner Ethel Zahne	1,050	14	Steamer Pasadena	500
26	Steamer Excelsior	238	14	Steamer Tillamook	625
26	Steamer Tillamook	507	16	Steamer Louise	666
29	Schooner Lizzie Bonner	537	16	Steamer Lakme	625
29	Schooner Jessie Minor	583	17	Schooner Peerless	600
Feb. 3	Schooner Excelsior	700	20	Steamer Jewel	500
3	Schooner Alice	528	15	Schooner Bertha Dolbear	450
3	Schooner Sadie	533	24	Steamer Bonita	480
3	Schooner El Norah	287	27	Schooner Serena Thayer	483
7	Schooner Louise	648	30	Schooner Monterey	283
7	Schooner Comet	700	30	Steamer Pasadena	500
7	Schooner Alcalde	666	31	Schooner S. C. Holmes	933
7	Steamer Pasadena	500	31	Schooner Meteor	1,330
8	Schooner Bonlah	680	31	Schooner Alice	450
10	Brig Courtney Ford	858	31	Schooner Comet	833
13	Schooner S. C. Holmes	933	June 4	Schooner Redfield	1,000
14	Steamer Excelsior	550	4	Steamer National City	27
14	Schooner Halcyon	540	4	Schooner Skagit	1,000
16	Brigantine Portland	1,000	5	Schooner Mary Buhne	283
19	Steamer Sunol	610	8	Schooner Bangor	916
21	Steamer Caspar	322	10	Schooner Fanny Adele	500
25	Steamer Pasadena	500	9	Steamer Tillamook	503
25	Steamer National City	466	12	Schooner Ray Sommers	583
25	Steamer Tillamook	503	13	Steamer Pasadena	500
29	Schooner Salvator	866	15	Steamer National City	158
29	Schooner Premier	666	15	Steamer Lakme	1,050
Mar. 2	Steamer Alcasar	223	19	Schooner Huene	666
2	Schooner Reporter	666	22	Barkentine Uncle John	666
4	Steamer Caspar	667	24	Schooner Louise	730
4	Schooner S. C. Falk	611	25	Steamer Alcasar	158
4	Schooner Lucy	600	28	Steamer Pasadena	500
8	Steamer Pasadena	500			
11	Schooner Jessie Minor	456			
14	Schooner Alice	666			
				Total	184,809

DELIVERED TO COAST LUMBER CRAFT.

1895.			1896.		
Dec. 7	Steamer Protection	375	Jan. 12	Steamer Excelsior	383
19	Steamer Lakme	383	Feb. 27	Steamer National City	283
20	Steamer Excelsior	66			
				Total	1,490

DEEP-WATER HARBOR.

RECAPITULATION.

Coast lumber craft:	Tons.
Discharged from.....	184,809
Delivered to.....	1,490
Total.....	186,299
Handled by—	
Southern Pacific Company.....	137,391
Los Angeles Terminal Company.....	48,908
Total.....	186,299

PORT LOS ANGELES V. SAN PEDRO (INNER HARBOR).

Tonnage handled during period July 1, 1895, to June 30, 1896, inclusive.

Port Los Angeles.			San Pedro.		
Discharged from—	Tons.	Tons.	Discharged from—	Tons.	Tons.
Deep-sea vessels—			Deep-sea vessels.....		
Cement.....	11,923				
Coal.....	13,122				
Coke.....	300				
Merchandise.....	7,077				
		33,031			
Local coast vessels—			Local coast vessels—		
Cement.....	800		Merchandise.....	9,182	
Coal.....	115,254		Lumber.....	184,809	
Coke.....	42				
Merchandise.....	15,965				
Lumber.....	28,025				
		180,395			193,971
Delivered to—			Delivered to—		
Deep-sea vessels—			Deep-sea vessels.....		
Grain.....	2,240				
Local coast vessels—			Local coast vessels—		
Grain.....	1,537		Lumber.....	1,490	
Merchandise.....	5,261		Merchandise.....	4,951	
		8,978			6,441
Total.....		202,404	Total.....		300,412

Merchandise at San Pedro:

Southern Pacific Company carried.....	Tons.
Los Angeles Terminal Railway carried.....	10,968
Lumber at San Pedro:	5,649
Southern Pacific Company carried.....	137,391
Los Angeles Terminal Railway and Southern California Railway carried.....	48,908

Names of deep-sea vessels discharged or loaded at Port Los Angeles.—Ships: Eclipso, Fingal, Lady Isabella, Eaton Hall, Port Elgin, Airlie, St. John, Dunboyne, Philadelphia, Chas. E. Moody, Dunsyre. Barks: Edinburghshire, Forfarshire, Fernbank.

Number of calls made.

	Port Los Angeles.	San Pedro.
Deep-sea vessels.....	14	0
Local coast vessels.....	156	116
Lumber craft.....	69	299
Total.....	239	414

No tonnage handled at anchorage or outer harbor of San Pedro.

Tonnage passing Port Los Angeles, from July 1, 1895, to June 30, 1896.

Discharged from vessels.	Tons.	Delivered to vessels.	Tons.
Merchandise.....	12,708	Merchandise.....	3,178
Grain.....	141	Grain.....	3,777
Flour.....	511	Milk stuffs.....	13
Milk stuffs.....	229	Fruit, dried.....	13
Fruit, green.....	20	Fruit, green.....	102
Vegetables.....	1,031	Honey.....	4
Hops.....	10	Packing-house products.....	15
Other agricultural products.....	969	Wool.....	56
Fish.....	66	Hides and skins.....	1,300
Wool.....	11	Asphaltum.....	12
Coal.....	128,876	Other mineral products.....	12
Coke.....	351	Iron, pig, etc.....	55
Bituminous rock.....	48	Cement.....	264
Clay.....	138	Beer, wine, etc.....	49
Stone.....	46	Petroleum, etc.....	84
Salt.....	553	Lumber.....	36
Other mineral products.....	42		
Iron, pig, etc.....	1,056		
Cement.....	12,732		
Brick.....	144		
Beer, wine, etc.....	290		
Sugar.....	2,236		
Petroleum, etc.....	2,712		
Other manufactures.....	516		
Lumber.....	28,325		
Miscellaneous.....	166		
Total.....	193,426	Total.....	5,978
Total discharged.....			Tons.
Total delivered.....			193,426
Grand total.....			8,978
			302,404

EXHIBIT No. 8.

Distances from Arcade Depot, Los Angeles.

	Miles.
Santa Monica.....	17.2
Port Los Angeles.....	20.4
End of Port Los Angeles Wharf, station 170 + 22.9.....	20.4
San Pedro.....	21.8
End of proposed San Pedro Wharf, station 170.....	25
Declez.....	48.97
Declez Quarry (+ 1.77).....	50.74
Chatsworth Park.....	32.9
Declez, to end of Port Los Angeles Wharf.....	69.37
Declez Quarry to end of Port Los Angeles Wharf.....	71.14
Declez Quarry to end of proposed San Pedro Wharf.....	75.74
Chatsworth Park to end of proposed San Pedro Wharf.....	57.9
Chatsworth Park to end of Port Los Angeles Wharf.....	53.3

SAN FRANCISCO, December 11, 1896.

NOTES ON DETACHED BREAKWATERS, BOTH FOREIGN AND AMERICAN.

[Compiled from the following authorities: Harcourt's Harbors and Docks; Transactions, Institution of Civil Engineers; Annual Reports of the Chief of Engineers, U. S. A.; Tide Tables, Coast and Geodetic Survey.]

CHERBOURG.

[Authorities: Harcourt's Harbors and Docks; Proceedings, Institute Civil Engineers, vol. 7, p. 350; vol. 16, p. 446; vol. 71, p. 466.]

See pls. 1 and 2, figs. 1 and 1a.

This breakwater was first formed by dumping in rubblestones, but the waves leveled it to low-water mark. It was not rendered stable until the present superstructure, concrete blocks, were placed on top.

This breakwater is the first modern instance of a rubble mound on a large scale in which the attempt was made by floating out hollow timber truncated cones and

filling them with small stone, upon the same principle as the crib work now largely employed in America; but, owing to the damage the cones sustained from storms, the system was abandoned and the mound was subsequently completed by depositing from barges. The superstructure was commenced at low-water level of large concrete blocks for the base, with solid masonry above. The average capacity of the concrete blocks is 700 cubic feet, weighing about 45 tons.

Pl. 1, fig. 1, shows location of breakwater, and pl. 2, fig. 1a, its section. Cherbourg Harbor is protected on the east by Berfleur, the south by the mainland, the west by Cape de la Hague 12 miles away. The width of the channel, due north, is 72 miles. (Ed.)

Mean rise and fall of tide, 17 feet.

ALEXANDRIA.

[Authority: Harcourt's Harbors and Docks.]

See pl. 1, fig. 2; pl. 2, fig. 2a.

Here a mound of concrete blocks weighing 20 tons was first laid on sea side, the interstices between the blocks filled with small rubble, and finally large rubble-stones were placed on the harbor slope. The concrete blocks were taken out in barges and slung out from a crane on a barge.

The harbor is protected on the north by Ennostos Point, on the east and south by the mainland; on the west, there is a reach of 40 miles. (Ed.)

LEGHORN.

[Authorities: Harcourt's Harbors and Docks; Proceedings, Institute Civil Engineers, vol. 71.]

See pl. 1, fig. 3, and pl. 2, fig. 3a.

This is composed of a mound entirely of concrete blocks carried out to the site between two pontoons and slung out from cranes on barges. The superstructure is of concrete—base and cone—with high masonry wall.

Leghorn is open to the west, there being a reach of 175 miles. To the southwest Corsica lies, 60 miles away, while the Tuscan Archipelago shelters it from the south. (Ed.)

MARSEILLES.

[Authorities: Harcourt's Harbors and Docks; Institute, vols. 16 and 18.]

Pl. 1, fig. 4; pl. 2, fig. 4a.

This is a rubble mound, with smallest stones on the bottom and assorted according to size. The seaside is covered with concrete blocks, weighing 25 tons and upward, dumped in. The superstructure, which forms rather a parapet to the quay than a regular superstructure, is founded at low water. This breakwater also serves as a quay.

The harbor is exposed on the west, there being a reach of 90 miles, while to the southwest Cape de Cruz, Spain, is 125 miles away. From west-northwest, around by the north to the south, the harbor is sheltered. (Ed.)

TRIEST.

[Authorizes: Harcourt's Harbors and Docks.]

Pl. 1, fig. 5; pl. 2, fig. 5a.

This is built of sorted rubble, the smallest stones at the bottom. The superstructure, which forms rather a parapet to the quay than a regular superstructure, consists of a concrete facing with rubble core.

The harbor is sheltered from the northwest around by the east to the southwest. On the west there is a reach of 40 miles. (Ed.)

Mean rise and fall of tide 2 feet.

PLYMOUTH, ENGLAND.

[Authorities: Harcourt's Harbors and Docks; Institute, vol. 5.]

Pl. 1, fig. 6; pl. 2, fig. 6a.

Was begun by dumping in stone, but the waves reduced the mound until the portion near and above low water was protected by pitching.

This breakwater, the largest detached work in England, is constructed in a depth

varying from 5 to 8 fathoms at low water, is a mile long, and is formed of loose rubble blocks of all sizes up to 10 or 12 tons each, thrown into the sea to form their own base and slope according to the action of the waves. The surface from low-water mark to its full height, which is 7 feet above high water, has been paved with masonry, and at the base of the sea slope, at the low-water level, there is a beam to protect it. The whole, except a portion of the masonry, is of limestone from the adjoining shores. This breakwater was built to protect the sound against the heavy swells which formerly rolled in with considerable violence during strong westerly and southwesterly gales.

Spring tide rises 15 feet, neap tide 8 or 9 feet.

ST. JEAN DE LUZ.

[Authorities: Harcourt's Harbors and Docks; Institute, vol. 71.]

Pl. 1, fig. 7; pl. 2, figs. 7a and 7b.

In the "Artha," or detached breakwater, the concrete blocks were carried out on barges. The concrete blocks entirely cover the mound.

In the "Socoa," or western breakwater, the mound settled under the weight of the superstructure and cracked. The face of this wall is curved. Waves sometimes rise 100 feet above the wall, and, driven inward by the wind, fall with great injury on the quay, rendering it unapproachable. Projections on the face have frequently been the cause of injury to the quay.

BREST.

[Authority: Harcourt's Harbors and Docks.]

Pl. 1, fig. 8; pl. 2, fig. 8a.

This is a rubble mound, slope 6 to 1 on sea side, 1 to 1 on harbor side, with a berm on harbor side at low water. The breakwater is heavily paved above low water.

Brest is on a deep bay, sheltered on all sides but the west.

Mean rise of tide, 21 feet.

CIVITA VECCHIA.

[Authority: Harcourt's Harbors and Docks.]

Pl. 1, fig. 9.

No details can be found of the construction of this breakwater.

PORTLAND, ENGLAND.

[Authorities: Harcourt's Harbors and Docks; Institute, vol. 121.]

Pl. 1, fig. 10; pl. 2, fig. 10a and 10b.

This breakwater was formed by dumping in rubble from a staging. The upper part of the mound, forming the detached breakwater, is protected by large stones. The superstructure is formed at low water. Large rubble blocks are deposited in the sea slope to high water. On the inner breakwater the superstructure is solid, made with coursed dimension stones on face with a coursed masonry core. The outer breakwater terminates in 9 fathoms of water. The stones vary in size with a fair proportion of stones of 6 and 8 tons.

The harbor is naturally sheltered from all except the heavy rolls from the southwest, which have a reach of 125 miles. (Ed.)

Rise of spring tide 6 to 7 feet, of neap, 2 to 3.

DELAWARE BAY.

[Authorities: Harcourt's Harbors and Docks; Institute, vol. 71; Ch. Engr.'s Reports, 1890 and 1894.]

Pl. 1, fig. 11; pl. 2, fig. 11a; pl. "Supplement to 2," figs. 11b, 11c, 11d.

This ice harbor is formed of an ice breaker or outer breakwater and a detached breakwater. It was begun in 1828 and finished in 1860. The rubblestones weigh from one-quarter of a ton to 7 tons, the larger for the exterior slopes.

In 1882 the work of closing the gap was begun. Mattresses 2 feet thick and 100 wide were sunk, on which rubble was thrown. The plan for superstructure has been modified several times. As being now carried out, it provides for the closing of the gap by depositing random stone so as to raise the structure to a height of 14 feet above low water, 20 feet wide on top, 40 feet at low water, and the slopes below this to be such as may be formed by the action of the sea; between low water and the top a slope of about 1 on 0.7, formed by heavy stone laid in position.

The following are the angles between the axes of the different sections of the works and the different points of land:

	Degrees
Breakwater and line to outer edge New Jersey coast.....	55
Gap and line to outer edge New Jersey coast.....	67
Breakwater and line to outer edge shoals.....	47
Gap and line to outer edge shoals.....	58½
Breakwater and line to middle exposure.....	30
Gap and line to middle exposure.....	49
Breakwater and line to end Cape Henlopen.....	13
Gap and line to end Cape Henlopen.....	25½
Mean rise of tide, 6 feet.	

OSWEGO, N. Y.

[Authorities: Harcourt's Harbors and Docks; Report Ch. of Engrs., 1893.]

Pl. 1, fig. 12.

This is of timber cribs, 35 feet wide by 35 feet deep, raised 13.5 feet above low water, heavily ballasted and sunk on a rubblestone foundation. The northwest winds, with a reach of 65 miles, strike the breakwater at an angle of 10° with the normal.

CETTE.

[Authorities: Harcourt's Harbors and Docks; Institute, vol. 18.]

Pl. 1, fig. 13; pl. 2, fig. 13a.

This is a rubble mound, faced from low-water mark on the sea side with beton blocks weighing 25½ tons thrown on. The superstructure is also of beton. Cette is open on the south and southeast to the full force of the Mediterranean seas. (Ed.)

CHICAGO.

[Authorities: Harcourt's Harbors and Docks; Report Ch. of Engrs., 1893.]

Pl. 1, fig. 14; pl. 2, fig. 14a.

This is a ballasted timber crib 30 feet wide by 32.5 feet deep, founded on rock. For building the foundation the crib was placed in position and loaded to within 4 feet of the bottom. Fine rock was then thrown in, which, passing through the grillage bottom, settled evenly under and around the sides and ends of the crib. The latter is then filled up with coarse stone and ripped with about 10 cords of heavy rock.

Chicago Harbor is fully exposed to the northerly, northeasterly, and easterly gales, the former with a reach of 130, the latter of 50 miles. (Ed.)

BUFFALO.

[Authorities: Harcourt's Harbors and Docks; Report Ch. of Engrs., 1893.]

Pl. 1, fig. 15; pl. 2, fig. 15a.

Six thousand feet of the detached breakwater has been built of timber cribs 38 by 38 feet. The underlying mud, which is from 10 to 19 feet thick and rests on rock, is dredged to the rock on slopes of 1 to 1 and filled with coarse gravel, which gives a good foundation for the cribs. The section shown in fig. 15a shows the section of the proposed extension of the breakwater. The depth of water averages 30 feet.

The southwesterly gales, with a reach over a long section of Lake Erie, strike the breakwater at an angle of about 10° with the normal.

ODESSA.

[Authority: Harcourt's Harbors and Docks.]

Pl. 1, fig. 16; pl. 2, fig. 16a.

This is a rubble mound. The superstructure is founded 32 feet below ordinary spring tide, and the base is raised about 4 feet higher. The Black Sea is very tempestuous.

Odesa is situated on a broad bay off the Black Sea. The winds from the south-east have a reach of 300 miles over the sea. (Ed.)

BARCELONA HARBOR.

[Authority: Institute, vol. 45, a copy from Revista de Obras Publicas, vol. 24, p. 50.]

No map.

"There are two breakwaters, the east in water with maximum depth of 66 feet, the west in water from 33 to 36 feet, and are entirely formed of large blocks of natural rock, described as first class when the stones are from 3 to 4 cubic yards and second class when they are from 1 to 2 cubic yards. The half of the mound facing the sea is formed, up to water line, of first-class blocks, and above water line the larger blocks are almost entirely employed. The slope of the exterior face is 1.5 to 1; of the interior face it is 1 to 1 up to water level; above that level the inner wall is nearly vertical. The width at the top, which is 30 feet above the sea level, is 60 feet. For the eastern breakwater the stone was conveyed in barges. The blocks were placed in continuous layers, 3 to 5 yards thick, over the entire width, by which means the undue heaping of stones in unsafe position was avoided.

"The extent of the breakwater is not given, but it is considerable."

Barcelona is in Spain, and situated on the shores of the Mediterranean Sea. It is fully exposed to the east and southeast. In the latter direction the Balearic Isles lie 100 miles away. (Ed.)

ANDROSSAN, SCOTLAND.

[Authority: Institute, vol. 120.]

Pl. 3, figs. 17 and 17a.

Androssan is on the Firth of Clyde, 50 miles below Glasgow. The breakwater is constructed up to 2½ feet above low water, with concrete in bags placed by divers from lighters. The largest bags are 28 feet long and contain between 40 and 50 tons. The superstructure is of concrete.

Androssan is open to the southwest, there being a reach of 70 miles up the Firth of Clyde from the Irish coast. (Ed.)

Mean rise of tide, 9 feet.

BOULOGNE.

[Authority: Institute, vols. 70 and 71.]

Pl. 3, figs. 18 and 18a.

This is a good example of the conversion of a jettied into a closed harbor; also of breakwaters founded on a sandy coast.

There is a mound below and a wall above. The attempt to provide against uneven settlement was made by giving a wide surface to the top of the mound and protecting the portion in front of the wall with large stones or bags of concrete. The face of the superstructure was designed perfectly straight, with only a slight batter and no projections.

Boulogne is exposed to the west and southwest; in the former there is a fetch of about 60 miles; in the latter at least 100. (Ed.)

The following are the tide levels:

	Feet.
Low water, ordinary spring tide.....	1.2
Low water, ordinary neap tide.....	8.7
Mean sea level.....	11.3
High water, ordinary neap tide.....	23.1
High water, ordinary spring tide.....	29.17
High water, equinoctial spring tide.....	30.5

COLOMBO, CEYLON.

[Authorities: Institute, vol. 87; Report Ch. of Engrs., 1890.]

Pl. 3, figs. 19 and 19a.

The following description is for the shore arm. The plan will doubtless be somewhat modified, for the superstructure, at least, on account of the behavior of the existing work during the severe storms on that coast. (Ed.)

The rubble for this breakwater was deposited from an 80-ton steam barge. The top of the mound was usually kept about 2 feet below the foundation level of the pier wall, and subsequently raised by divers. Large blocks of stone were dumped on the sea and harbor berms. In April, 1878, an unusually heavy southwest monsoon swept away a 14-ton concrete block from the second upper course of the scar end. Rubble and 10-ton bags of concrete extend about 5 feet above the base.

Winds and waves.—The axis of the breakwater makes an angle of 80° with the northwest and 58° with the southwest monsoon. That from the southwest is the most severe, and that of July, 1878, which somewhat injured the work, made waves 15 feet high from trough to crest, with a velocity of about 35 feet per second.

The worst weather is from the southwest and occurs during June, July, and August. The general direction of the wind during these months is from west to southwest; and the heaviest wave stroke against the breakwater is from west-southwest. Extended observations show that the average wave period is from nine and one-half to sixteen seconds.

It 1878 it was found that the velocity in the offing of a long southwest wave of a series was 16 miles per hour. It was supposed at that time that 9 feet was the maximum height of waves at Colombo, but subsequent observations showed that waves rise to 12 feet in the offing and to 15 feet just outside the breakwater.

As the harbor is open to the north, careful observations were made of the maximum heights attained by waves during the northwest monsoon, and it was found that the worst weather and waves came from the west-northwest during December, January, and February. Between the pier head and the opposite shore the gauge registered 6.5 feet in December, 1879, and January, 1880, and gave way when it is believed the waves rose 7 feet from trough to crest. Bed of harbor is sand

Period of waves.

Date.	Average period of waves.	Remarks.
1880.	<i>Seconds.</i>	
June 9	10	Sea moderate; wind calm and squally, from northwest to northeast.
June 19	10	Sea heavy, west; wind fresh, west-southwest.
June 25	10.5	Heavy swell, west-southwest; wind light, south-southwest.
June 28	12.5	Heavy swell, west; wind calm.
July 13	12	Sea heavy, west-southwest; strong wind and squalls from southwest.
July 28	9	Strong wind and sea from west.
Aug. 1	16	Long swell, west-southwest; wind fresh, southwest.
Aug. 16	9.5	Sea heavy, west-southwest; heavy squalls from southwest.

Height of waves.

Date.	Height of waves.	Remarks.
1878.	<i>Ft. Ja.</i>	
Mar. 5	5 6	A. m.; wind west-southwest, light.
Mar. 5	5 0	Noon; very heavy swell from west-southwest.
Mar. 5	5 0	P. m.; wind west-southwest, blowing fresh; very heavy swell.
1879.		
Dec. 11	5 0	A. m.; wind light, west; heavy swell, west-northwest.
Dec. 11	5 0	Noon; wind fresh from west-northwest; sea heavy, west-northwest.
Dec. 17	5 6	P. m.; wind very strong, northwest; sea very heavy, west-northwest.
Dec. 17	6 0	P. m.; wind strong, north-northeast; sea very heavy, west-northwest.
Dec. 18	5 6	Noon; wind strong from north; sea very heavy, short swell, west-northwest.
Dec. 18	5 6	P. m.; wind strong from northeast; sea very heavy; short swell, west-northwest.
Dec. 19	6 6	P. m.; wind fresh, northwest; heavy short sea, northwest.
1880.		
June 15	5 0	P. m.; wind northeast, light; sea very heavy, northwest.
June 16	5 0	P. m.; wind east, light; sea very heavy and short, northwest.
June 19	5 0	P. m.; wind strong, northwest; sea very heavy, northwest.
June 19	6 6	P. m.; wind northeast, light; sea very heavy, northwest.
June 24	5 0	P. m.; wind west-northwest, strong; very heavy swell, west-northwest.
June 27	5 0	P. m.; wind west-northwest, strong; heavy short swell, northwest.
June 28	5 0	P. m.; wind west-northwest, strong; very heavy short swell, northwest.
June 29	5 6	P. m.; wind west-northwest, strong; heavy swell, northwest.
Feb. 17	5 0	P. m.; wind southwest, light; heavy swell, west-southwest.
1881.		
Jan. 25	5 0	A. m.; wind north; sea north.
Jan. 25	5 6	Noon; wind north; sea north.
1882.		
Jan. 2	5 0	A. m.; wind northeast; slight swell, north.

MICHIGAN CITY, IND., HARBOR OF REFUGE.

[Authority: Reports Ch. of Engrs., 1882, 1893, 1894.]

Pl. 3, fig. 20.

Lying at the head of Lake Michigan, this harbor is fully exposed to the north and northwest winds, the strongest known to the lakes, and the violence of the sea is sometimes felt far inside the creek. The outer harbor basin was projected in 1870 and completed in 1884.

Outer or detached breakwater.—In 1882 the project for a detached breakwater was adopted. Five hundred feet of it have been built. It is composed of crib work, 100 by 30 by 22½ feet, sunk on pile foundations, 76 piles to one crib, piles driven in water from 24 to 27 feet deep to a penetration of from 15 to 24 feet, and sawed off at grade 22½ feet below the zero of the gauge.

The north gales strike normal to the eastern arm of the detached breakwater; the northwest gales strike normal to the western arm. The two arms make an angle of 135° with each other. (Ed.)

SAND BEACH, MICH., HARBOR OF REFUGE.

[Authority: Ch. Engr.'s Reports, 1873, 1874, 1876, 1877, 1893.]

Pl. 3, fig. 21.

Is on Lake Huron, 60 miles north of its outlet into St. Clair River. From the St. Clair River, at the foot of Lake Huron, to its northern extremity, at old Pointe and Barque, the peninsula that juts into Lake Huron and incloses Saginaw Bay has neither harbor nor safe holding ground throughout its 80 miles of stormy and inhospitable coast, and the cape is fully exposed to the force of all the gales from the northeast to southeast, and particularly those from the northeast quarter, with a fetch of 90 miles across the lake. The storms of the lakes are sudden and violent, and the sea rises and becomes dangerous with a rapidity unknown on the seaboard. Such is the nature of the coast that a harbor had practically to be inclosed from the open sea by massive breakwaters, furnishing a sheltered area outside the 12-foot curve of some 300 acres.

The project was adopted in 1873 and completed in 1885. The harbor works were built in three sections, each of heavy timber cribs, 38 feet wide, filled with stone ballast. The west breakwater incloses the harbor on the north side, and starting in shallow water 750 feet from the shore line, extends about south-southeast 1,500 feet, and a width of crib increasing from 19 to 26 feet.

The main breakwater lies about southeast and northwest, 4,672 feet long, with a uniform width of crib of 38 feet.

The south breakwater lies north and south, protecting the harbor on the east, with a length of 1,956 feet and a width varying from 18 to 26 feet.

The cribs are of timber, bolted together, ballasted with stone and planked on top. The bottom of the lake here is rock. The cribs have a grillage bottom, with spaces about 12 inches square, through which small stones are dropped to form a level foundation. The average depth is 30 feet; height above surface of lake, 8 feet.

The inshore end of the west breakwater lies in but 54 feet of water.

DUNKIRK, N. Y.

[Authority: Annual Reports Ch. of Engrs., 1870, 1884, 1893, 1894.]

Pl. 3, fig. 22.

In 1827 the original project was adopted, and provided for the construction of a pier running out from the west shore of the indentation and a detached breakwater parallel with the pier and about 2,000 feet distant from the city front. In 1848 the breakwater was demolished.

The present plan was adopted in 1870. The breakwaters and piers are of crib work, heavily ballasted with rock and decked over. At first the cribs were but 20 feet wide. The bottom was afterwards changed to grillage with spaces 1 foot square, through which rock can fall for a foundation.

Dunkirk Harbor is fully exposed to the north and northwesterly gales. (Ed.)

ASHLAND, WIS.

[Authority: Reports Ch. of Engrs., 1880, 1893, 1894.]

Pl. 3, fig. 23a.

The southern end of Chequamegon Bay forms the harbor of Ashland, and as the length of the bay is considerable, it was necessary to protect the wharves from the waves to enable vessels to use them at all times. The approved project is for the construction of a pile, slab, and rock breakwater 8,000 feet long, etc.

The breakwater consists of three rows of piling filled in with slabs, which are held in place by large rock ballast. Major Sears reports that finally this breakwater will have to be reinforced by a solid bank of riprap. The piles are placed 4 feet center to center.

MILWAUKEE BAY HARBOR OF REFUGE.

[Authority: Reports Ch. of Engrs., 1885, 1893, 1894.]

Pl. 3, figs. 24 and 24a.

The project was adopted in 1881 and provides as shown in fig. 24.

The north arm of the breakwater is completed. The most northerly section of it, 600 feet, is comprised of cribs each 100 feet long and 20 feet wide, and the remaining 1,850 feet of 37 cribs, each 50 feet long by 24 feet wide.

The dimensions of the cribs forming the main arm to the northward of the opening are 50 feet by 24 feet by 22½ feet, with the exception of one immediately northward of the opening, which is 100 feet long by 24 feet wide by 22½ feet high. Over all these a superstructure has been built to a height of 5½ feet above datum. The breakwater is built in from 8 to 35 feet of water.

Section, exposure, and damage to outer arm.—The original width contemplated for the outer arm of the breakwater was 30 feet, but the elbow having been reached with cribs 24 feet wide, without any of them being overturned, it was thought to have been demonstrated that a width of 24 feet was sufficient. The most severe storms undoubtedly come from the northeast, and it was thought that the exposure of the eastern arm (the line of which runs south 11° west) would be no greater than that of the northern arm (the line of which runs south 25° east). But considering the difference in the depth of water in front of the two arms, the shelter afforded during northerly gales to the northern arm by North Point, and the angle at which the storms strike, it is not surprising that the eastern or outer arm is found to be more severely tried by easterly and south-easterly seas than the northern arm by the severe northeast storms. Already in the eastern arm 55-foot cribs and one 100-foot crib have been overthrown.

In the storm of February 12, 1894, dynamometers were placed on either side of a crib 64 feet above the water. The pressure registered by that on the lake side was more than 1,430 pounds (all that the dynamometer would measure) and by that on the harbor side less than 200 pounds per square foot. Wind northeast, velocity 36 miles.

In the storms of April 8 and 9, 1894, and May 18, 1894, both dynamometers were 24 feet above the water. In the first the dynamometer on the harbor side registered 3,460 pounds (all it would register) per square foot and the other less than 300 pounds. Wind northeast to southeast, velocity about 39 miles. In the second storm the dynamometers read, respectively, 1,970 and 316 pounds. Wind north to northeast, velocity about 40 miles.

The maximum height of the storm waves here is 13 feet. The stones on the lower part of the mound weigh about 250 pounds up to about 23 feet below the water surface. Above that plane 500-pound stones are used, experience finds, safely up to about 13 feet below the water surface.

BURLINGTON, VT.

[Authority: Annual Reports Ch. of Engrs., 1896, 1898, 1894.]

Pl. 4, figs. 25 and 25a.

Fig. 25a gives the plan of section adopted for extending the breakwaters, and also for repairing the superstructures of old decayed cribs. Here the small stones of the core weigh about 200 pounds, while the facing stones weigh from 1 to 5 tons. They are slung in place from a derrick running on a track placed on top of the crown, while the smaller stones are run down back of them and lightly packed with a pole.

GLOUCESTER, MASS.

[Authority: Annual Reports Ch. of Engrs., 1885, 1887, 1893, 1894.]

Pl. 4, figs. 26 and 26a.

This is the most important harbor between Boston and Portland. It is situated at the southeastern extremity of Cape Ann, 20 miles northeast from Boston. It is easily entered when the dangerous storms of this coast occur, and provides a secure, ample shelter for all classes of vessels, except from south winds, and from these a moderate extent of protected anchorage is afforded in the inner harbor.

It was for protection of the outer harbor from the southerly and southeasterly storms that the breakwaters were planned.

The understructure is an enrockment of granite rubble having its top at the level of mean low water. Its inward slope is 1 on 1, and seaward 1 on 2. The superstructure is a granite wall with a concrete filling, 10 feet wide at the top and rising 8 feet above mean high water.

The bottom is a coarse sand and shingle resting on the underlying ledge and furnishes a good foundation. As regards violent action of the sea, the breakwaters are much more favorably situated than either of those projected for Sandy Bay, Massachusetts. Average depth 17.4 feet at mean low water.

Mean rise and fall of tide 8.9 feet.

HYANNIS, MASS., HARBOR OF REFUGE.

[Authority: Reports Ch. of Engrs., 1893, 1894.]

Pl. 4, fig. 37.

This harbor of refuge is on the southern shore of Cape Cod on Nantucket Sound. It is sheltered on the east and west. On the southwest Marthas Vineyard is 18 miles away. On the southeast Nantucket is 25, which practically represents the longest fetch of the waves, those with a southeasterly gale. (Ed.)

The mean rise and fall of the tide is 3.75 feet.

Before improvement it was an open roadstead, exposed to southerly storms, with depths varying from 10 to 20 feet in the inner harbor.

In 1827-1838 a breakwater of riprap granite 1,170 feet long was constructed, covering an anchorage of about 175 acres. Between 1852 and 1882 extensive repairs were made in increasing the width of its base and the size of the stone forming its sides and top. This was completed in 1882.

Mean rise and fall of tide 3.1 feet.

SANDY BAY, CAPE ANN, MASSACHUSETTS.

[Authority: Reports Ch. of Engrs., 1892, 1893, 1894.]

Pl. 4, fig. 28a.

Sandy Bay is situated at the northeastern extremity of Cape Ann. The shore lines of the bay form a little less than a right angle, and their directions are nearly north and south and east and west. The rocky island of Straitsmouth forms the eastern extremity of one shore line and the steep headland of Andrews Point the northern end of the other. Following the line of the proposed breakwater, the bay is 2½ miles wide, with a depth, approximately, of 2 miles.

The bay on the land side is perfectly protected by steep, high hills, but it fronts the northeast and is open to the full force of the violent northerly and easterly gales of this coast.

The great seas of the ocean, however, in a degree are broken by the sunken rocky ledges called "Averys Ledge," the Dry and Little Salvages, the Flat Ground, and Abners Ledge, which are directly at the mouth of the bay. Inside these entrance ledges the bay is entirely unobstructed and has an average depth of 50 feet at mean low water.

The original project (1884) proposed a continuous breakwater 9,000 feet long, divided into two branches; one starts at Averys Ledge and runs in a direction a little west of north to Abners Ledge, 3,600 feet; the other extends 5,420 feet from Abners Ledge in a northwesterly direction and terminates at the 84-foot contour off Andrews Point.

The axis of the proposed breakwater is approximately at the inner edge of the ledges at the entrance of the bay and about 1 mile inside the Salvages and Flat Ground, which receive the first shock of easterly storm waves.

The southern entrance to the proposed harbor lies between Straitsmouth Island and Averys Ledge, and is to be 1,800 feet wide and at least 80 feet deep. The northern entrance, near Andrews Point, is 2,700 feet wide and 80 feet deep.

The approved section for the entire work is as follows: The body is of rubble-stone. On the sea side, from the bottom to 15 feet below mean low water, a slope of 1 on 1.5; thence to mean low water, 1 on 3; thence to 18 feet above mean low water, 1 on 1; width of crest, 20 feet, and the rear slope, 1 on 0.73 to mean low water; thence to the bottom, 1 on 1.

The body of the mound consists of "small" stones, of which one-fourth must weigh not less than 4 tons each, one-half must average 2 tons each, and one-fourth must weigh from 50 to 1,000 pounds each. They are deposited so as to form the approved section of the breakwater to the grade of low water. Above low water the "large" stones will be carefully placed. They are blocks of the largest sizes furnished by the quarries, none less than 4 tons in weight and to average 6 tons.

Mean rise and fall of tide, 8.6 feet.

POINT JUDITH, R. I., HARBOR OF REFUGE.

[Authority: Annual Reports Ch. of Engrs., 1894 and 1895.]

Pl. 4, figs. 29 and 29a.

This point is an especially bad one for boats to pass in bad weather. The only sheltering land is Block Island, which bears south-southwest 12 miles. Point Judith Neck protects the harbor on the northeast, while the proposed breakwaters, with one arm running northeast and the other northwest, are designed to give protection against easterly, southerly, and westerly storms. (Ed.)

Only a small part of this proposed breakwater has been built. It will be in from 3 to 5 fathoms of water. (See fig. 29a.)

Tides.—Coast survey, extreme high water + 3.7 feet; mean high water + 3.1 feet; mean water + 1.75 feet; mean low water + 0; extreme low water - 0.2 foot; mean rise and fall in the ocean, 3.1 feet.

STONINGTON, CONN., HARBOR OF REFUGE.

[Authority: Annual Reports Ch. of Engrs., 1893, 1894, 1895.]

Pl. 4, figs. 30 and 30a.

This harbor is protected on the north by the mainland, on the east by a spit of land called Napatier Point. Fishers Island lies almost due south and southeast, distant 3 miles. It is on Block Island Sound, a body of water protected to a large extent by Block Island, Long Island, and the sunken reef extending out from Montauk Point. (Ed.)

Between 1875 and 1880 the western breakwater, running southeast 2,000 feet from Wampasset Point to 18 feet depth of water, was built.

The present project provides for an eastern or outer breakwater as a protection to the outer harbor; this breakwater, about a half mile long, to extend from the vicinity of Bartlett Reef to the vicinity of the Middle Ground Shoal, or until it gives sufficient protection to the harbor against southerly winds.

At the time of submitting the report for 1895 a portion of this breakwater had been brought up to mean high water. It is composed of a rubble mound with the smaller stones inside and the larger ones in the facing. How high it is to be built above mean high water is not stated.

Mean rise and fall of tide, 2.75 feet.

NEW HAVEN, CONN.

[Authority: Reports Ch. of Engrs., 1894 and 1895.]

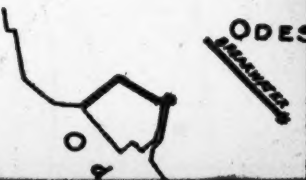
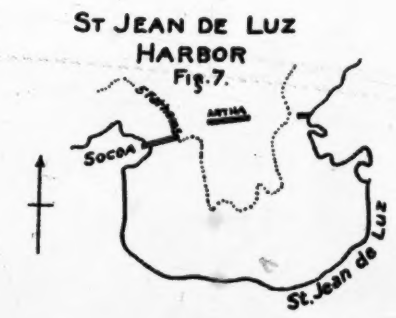
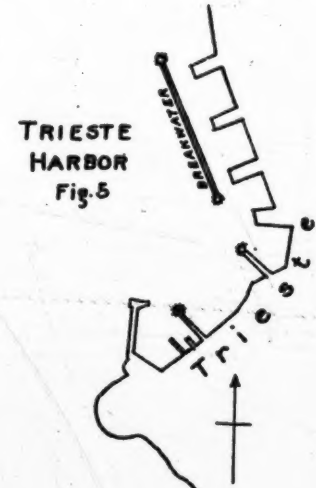
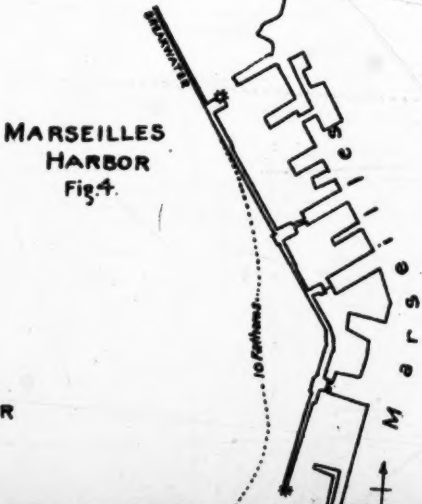
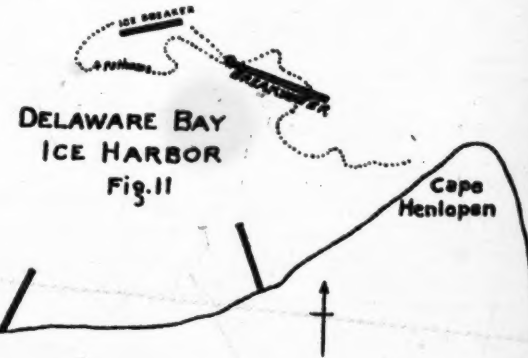
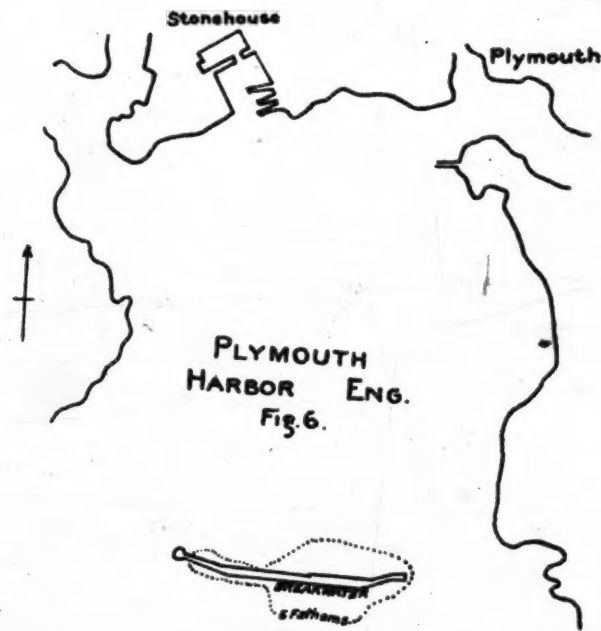
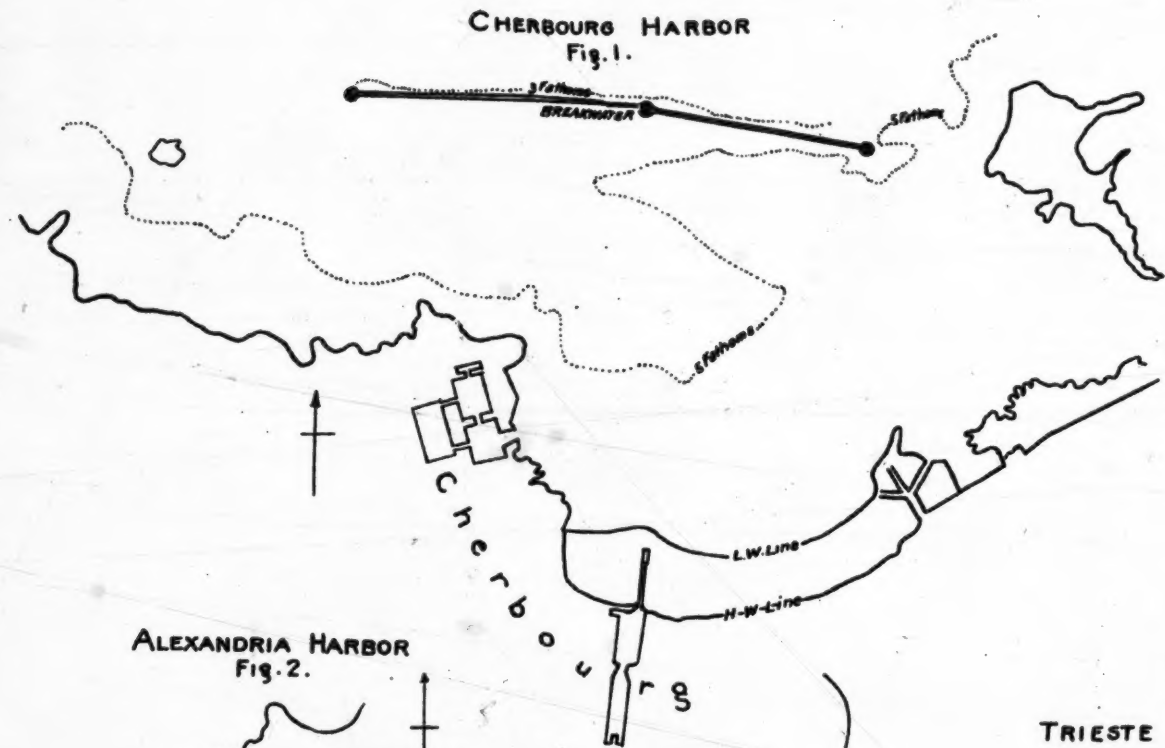
Pl. 4, fig. 31a.

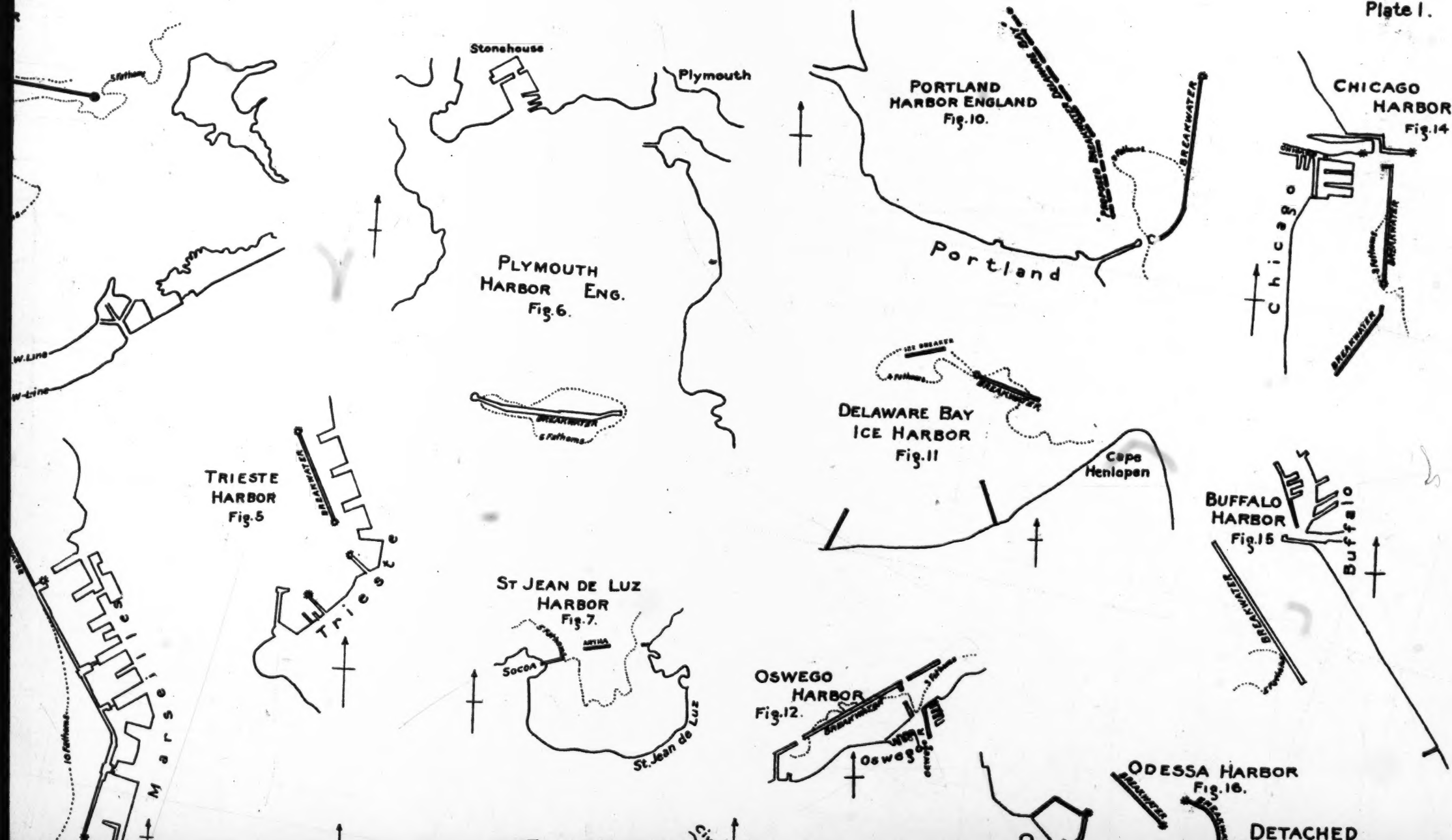
New Haven Bay is protected on the west, north, and east. On the south the waves have the full width of Long Island Sound at its broadest part, 18 miles. Southwesterly gales also have a long reach. (Ed.)

The project consists roughly of two breakwaters, one extending due east from near Five Mile Point, and the western one, to shelter the bay from the southwest, to extend in a northwesterly and southeasterly direction, overlying Ludington Rock.

The approved section of the rubble mound is as follows: 12 feet wide on top; top 6 feet above mean high water; outer slopes of 1 on 2; inner, 1 on 1. The average height of the eastern breakwater is 32 feet; that of the western, 28 feet.

Mean rise and fall of tide, 6 feet.





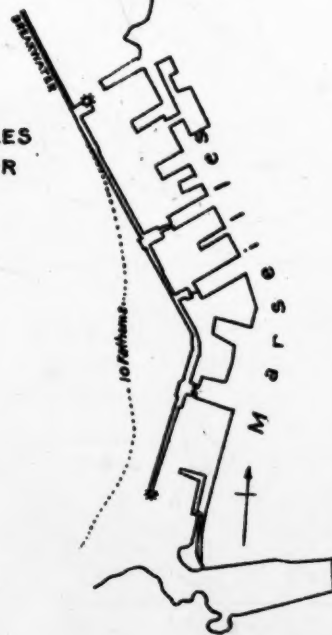
ALEXANDRIA HARBOR
Fig. 2.



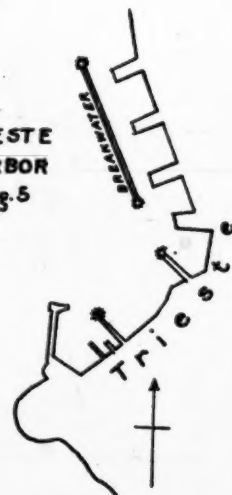
LEGHORN HARBOR
Fig. 3.



MARSEILLES HARBOR
Fig. 4.



TRIESTE HARBOR
Fig. 5.



PLYMOUTH HARBOR ENG.
Fig. 6.



ST JEAN DE LUZ HARBOR
Fig. 7.



OSWEGO HARBOR
Fig. 12.



CIVITA VECCHIA HARBOR
Fig. 9.



BREST HARBOR.
Fig. 8.

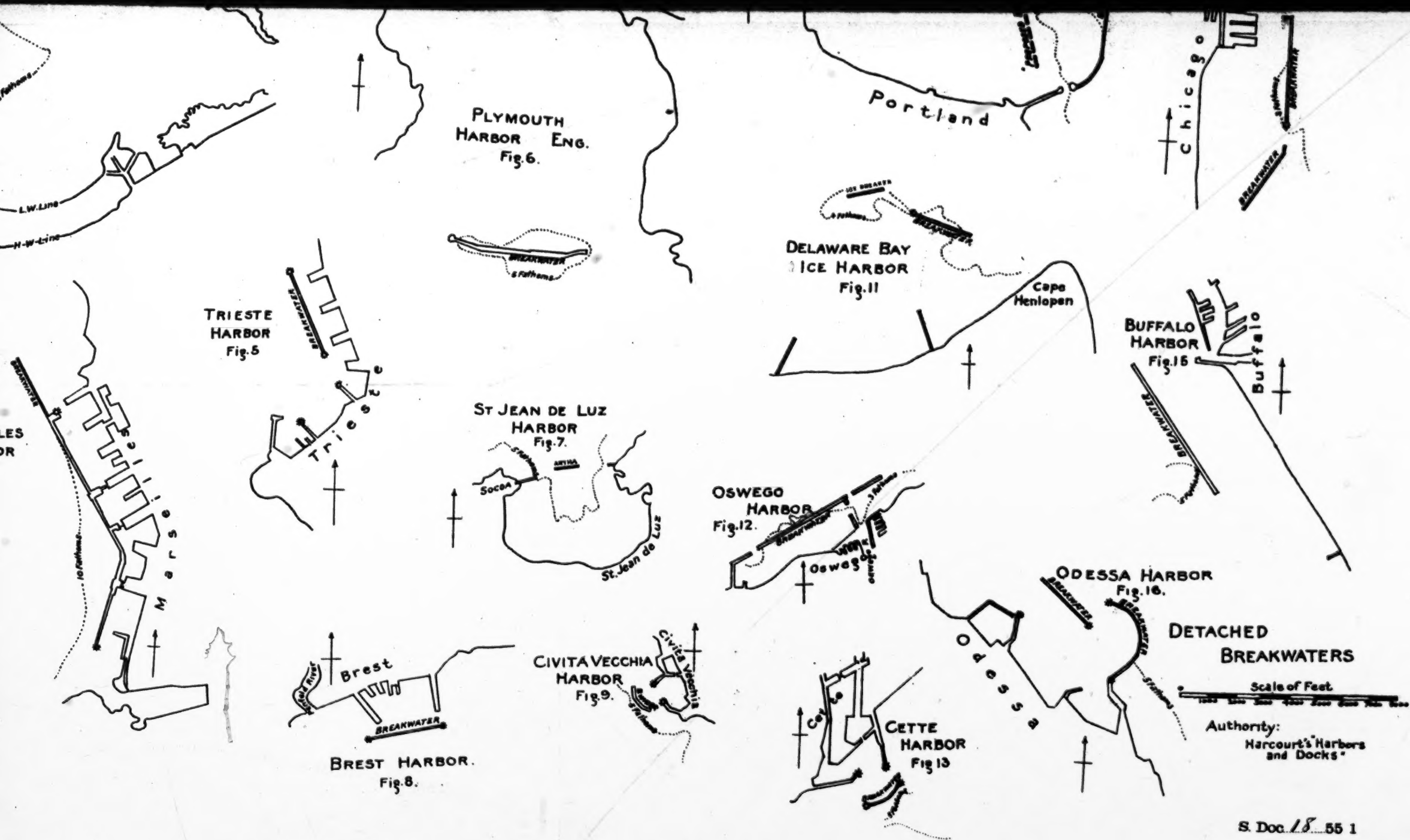


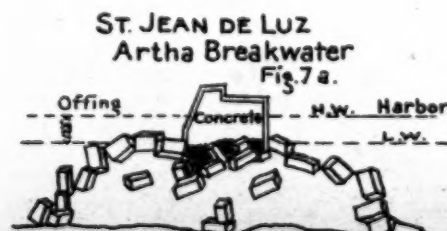
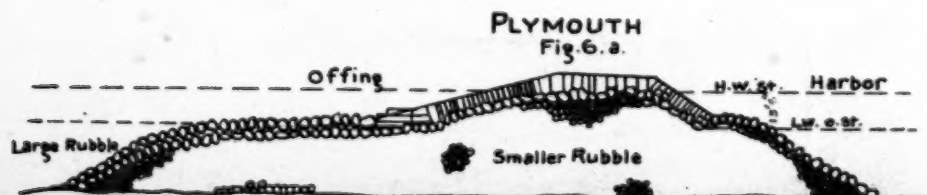
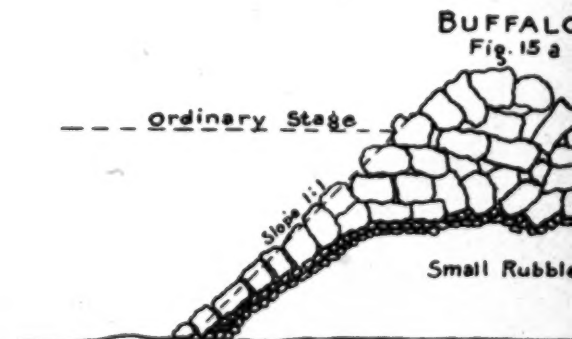
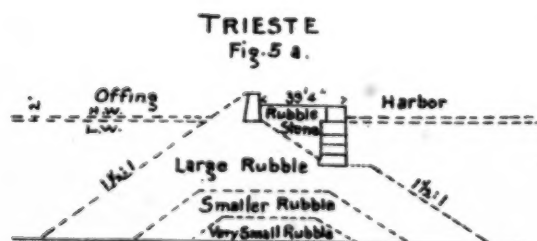
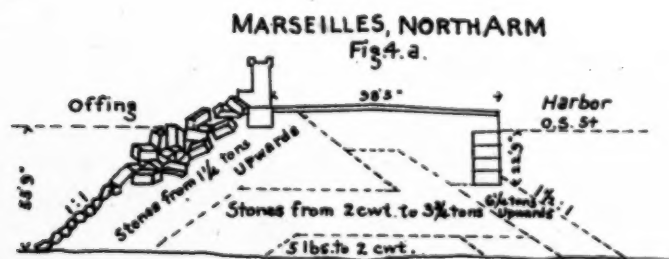
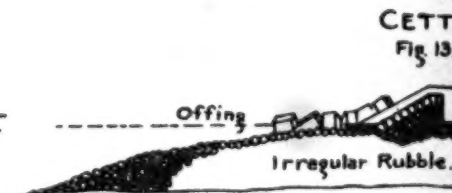
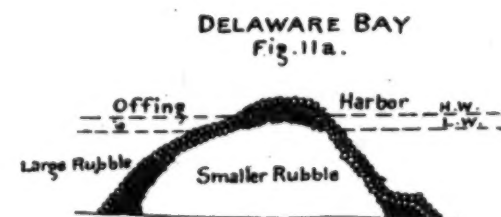
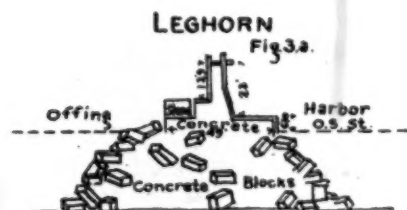
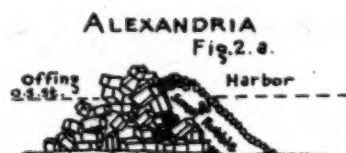
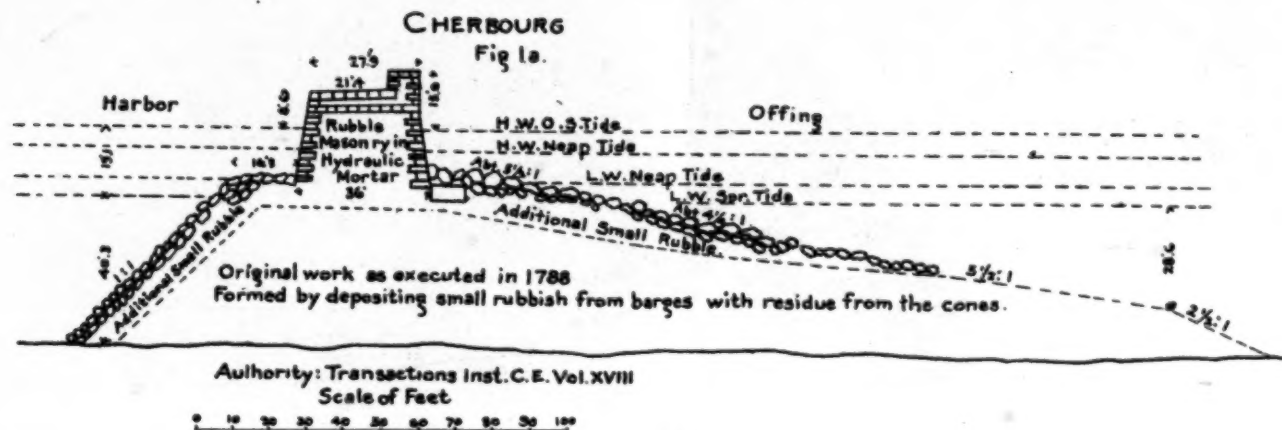
CETTE HARBOR
Fig. 13



DELAWARE BAY
ICE HARBOR
Fig. 11



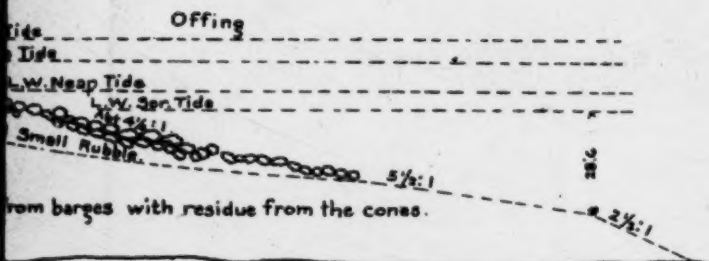




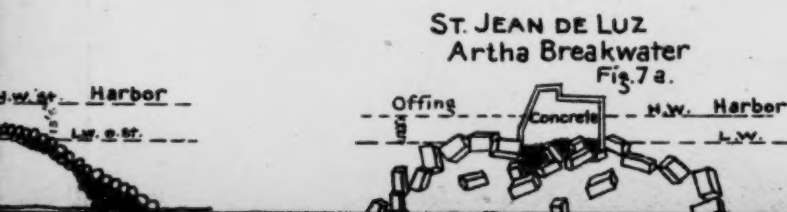
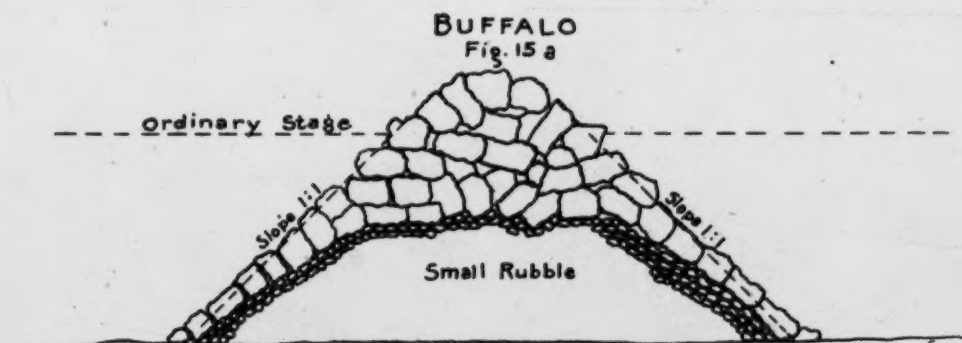
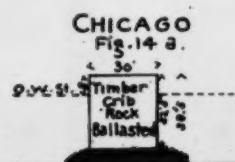
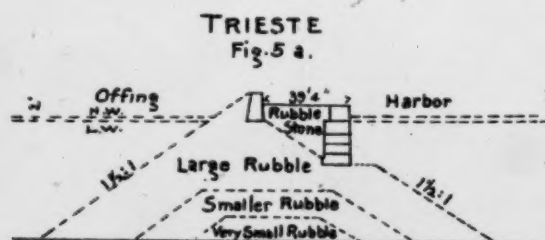
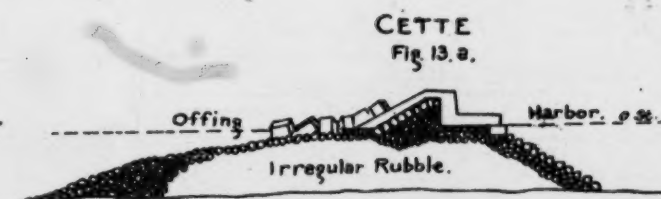
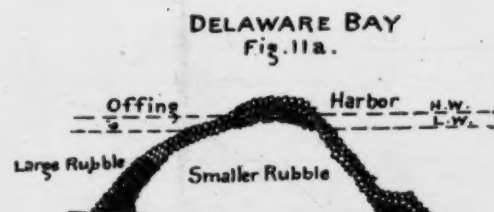
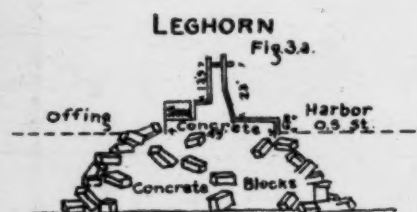
Mud overlying Rock. Dr.
and replaced by concrete

Scale

0 10 20 30 40 50 60 70 80 90 100



XVIII



Mud overlying Rock. Dredged to rock and replaced by coarse gravel.

Scale 10 20 30 Feet.

ALEXANDRIA
Fig. 2. a.



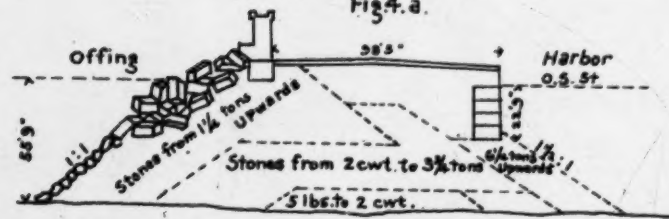
LEGHORN
Fig. 3. a.



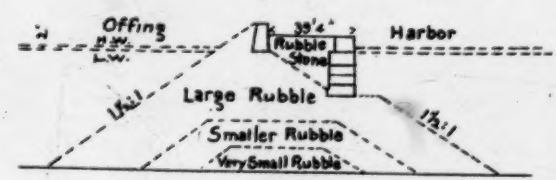
DELAWARE BAY
Fig. 11. a.



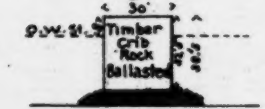
MARSEILLES, NORTH ARM
Fig. 4. a.



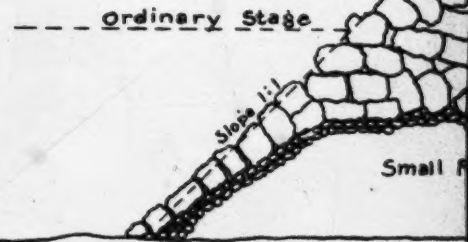
TRIESTE
Fig. 5. a.



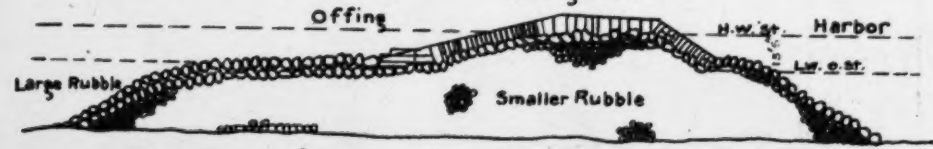
CHICAGO
Fig. 14. a.



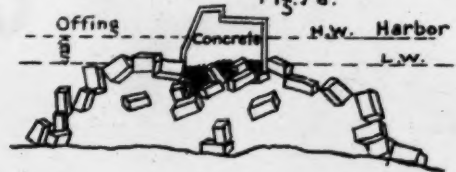
BUFF
Fig.



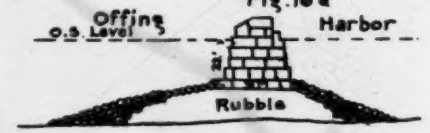
PLYMOUTH
Fig. 6. a.



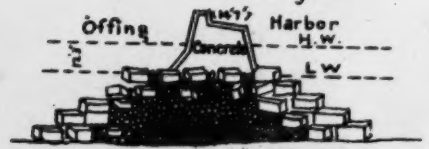
ST. JEAN DE LUZ
Artha Breakwater
Fig. 7. a.



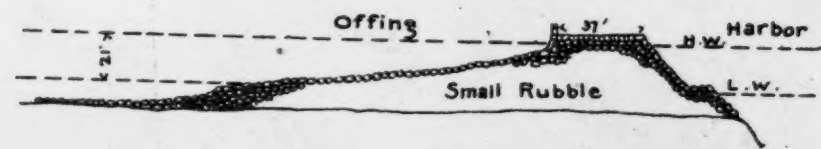
ODESSA
Fig. 16. a.



ST. JEAN DE LUZ
Socoa Breakwater
Fig. 7. b



BREST
Fig. 8. a.



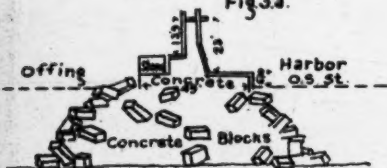
SECTIONS OF BREAKWATER

Scales: Figs. 1a and 15a as
Scale for other



Authorities: Fig. 1a - Transactions
14a - Annual Report
15a -
All Others - Harcourt's

LEGHORN
Fig. 3. a.



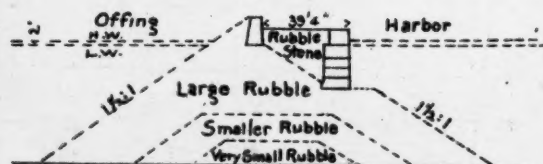
DELAWARE BAY
Fig. 11. a.



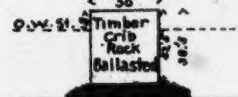
CETTE
Fig. 13. a.



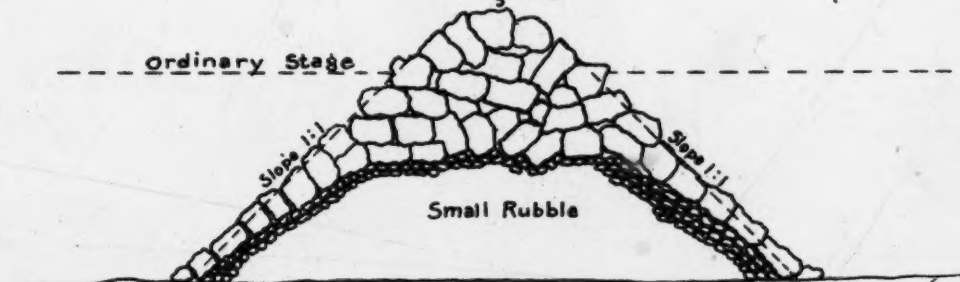
TRIESTE
Fig. 5. a.



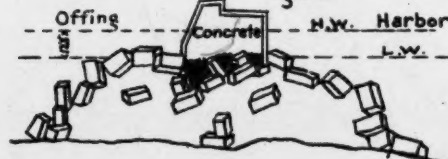
CHICAGO
Fig. 14. a.



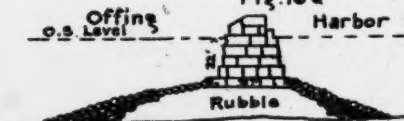
BUFFALO
Fig. 15. a.



ST. JEAN DE LUZ
Artha Breakwater
Fig. 7. a.



ODESSA
Fig. 16. a.



Mud overlying Rock. Dredged to rock
and replaced by coarse gravel.

Scale 0 10 20 30 Feet.

SECTIONS OF BREAKWATERS SHOWN ON PLATE I

Scales: Figs. 1a and 15a as shown.

Scale for others.

0 50 100 150 200 Feet.

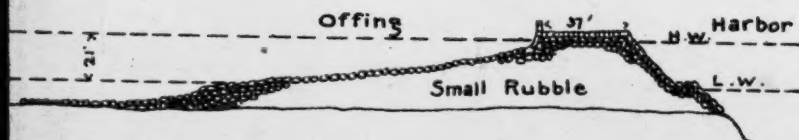
Authorities: Fig. 1a - Transactions Inst. C.E. Vol. XVIII.

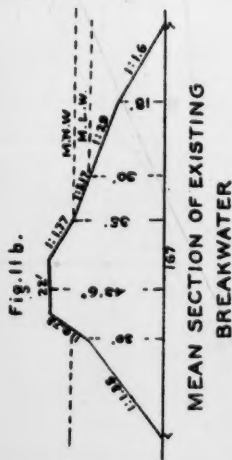
14a - Annual Report Ch. of Engrs 1894.

15a - " " 1895.

All Others - Harcourt's "Harbors and Docks"

BREST
Fig. 8. a.



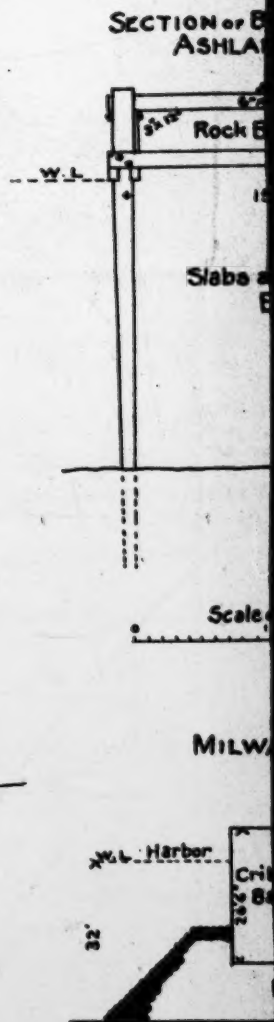
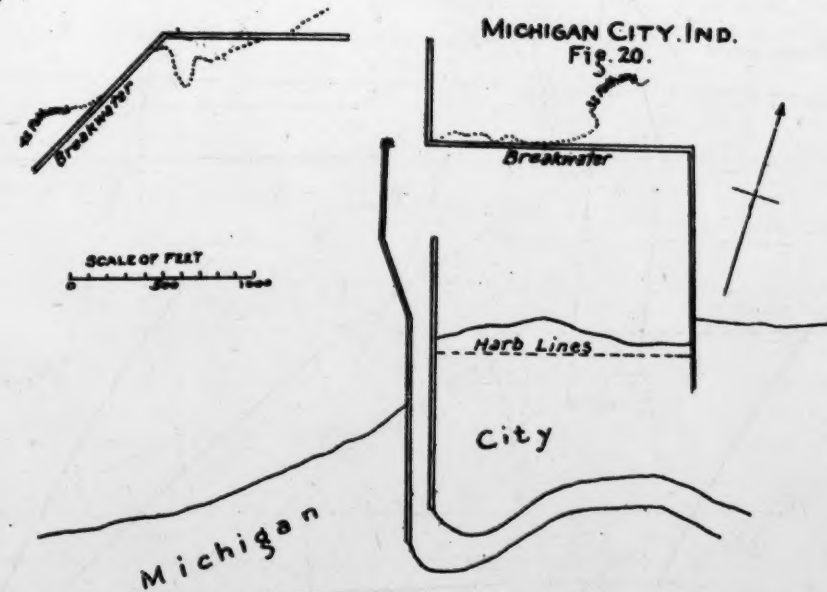
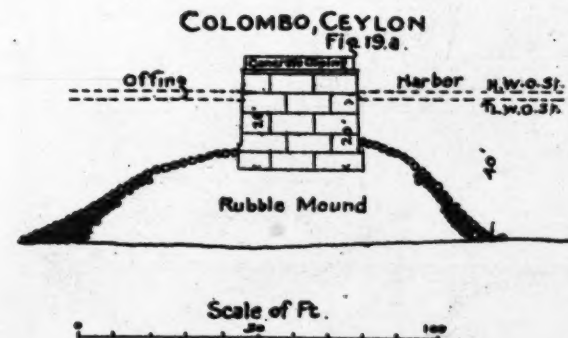
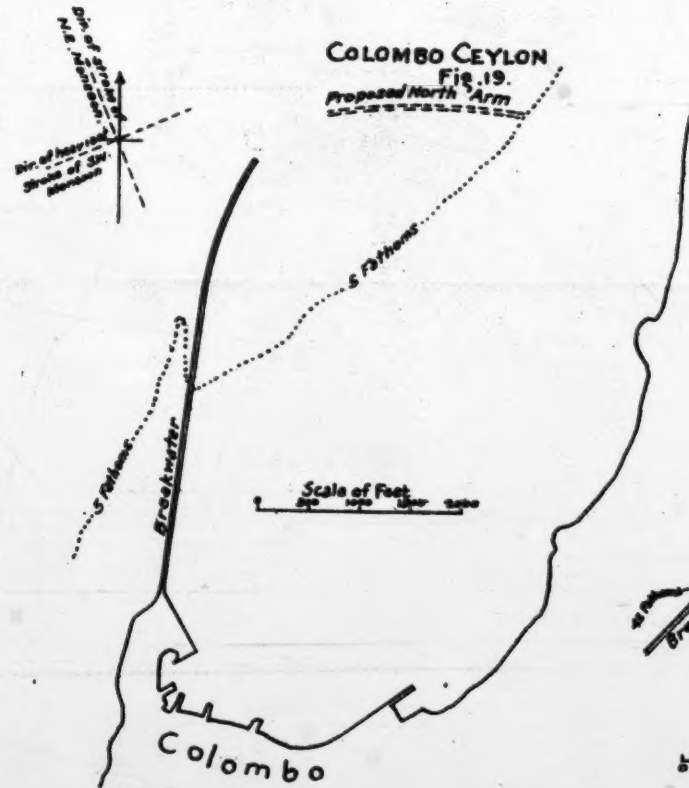
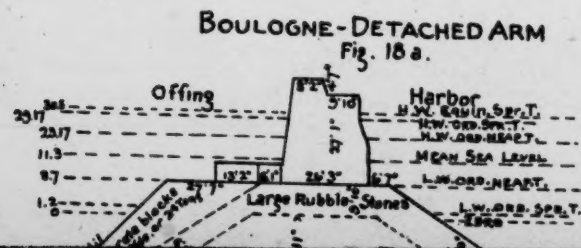
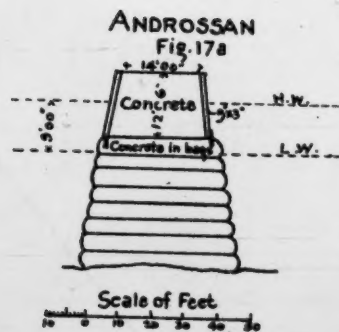
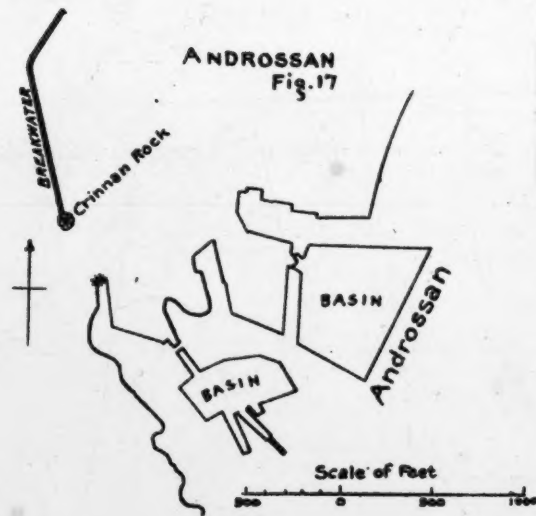


Supplement to Plate 2.

SECTIONS OF DEL. BREAKWATER

Authority: Report Ch. of Engrs. 1890.

S. Doc 1855 1



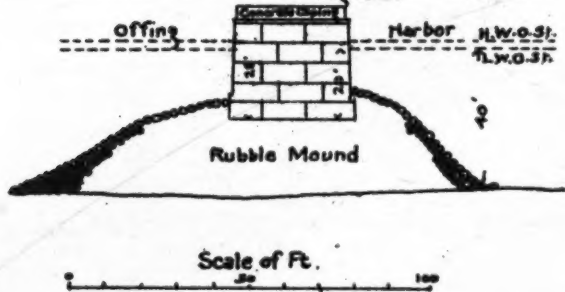
Y LON

9.

m

223

COLOMBO, CEYLON
Fig. 19.a.



SECTION OF BREAKWATER
ASHLAND, Wis
Fig. 23.a.

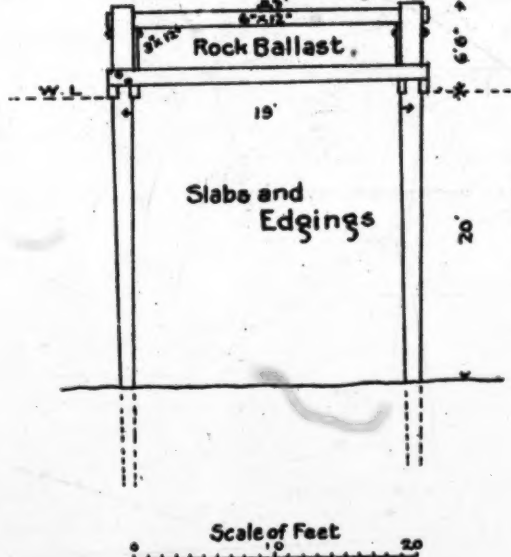
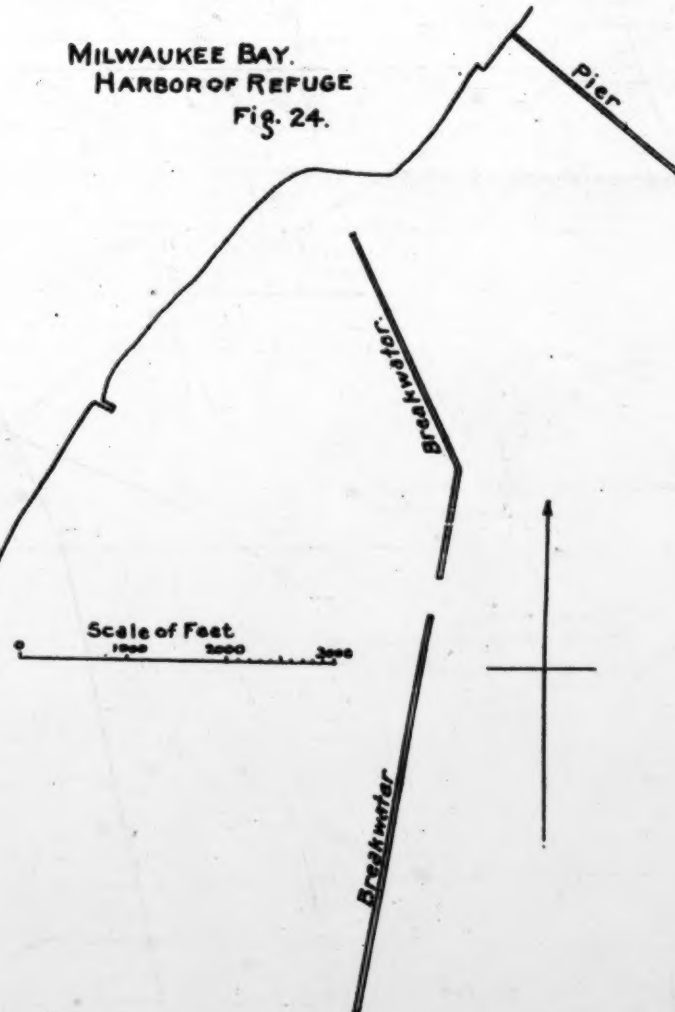
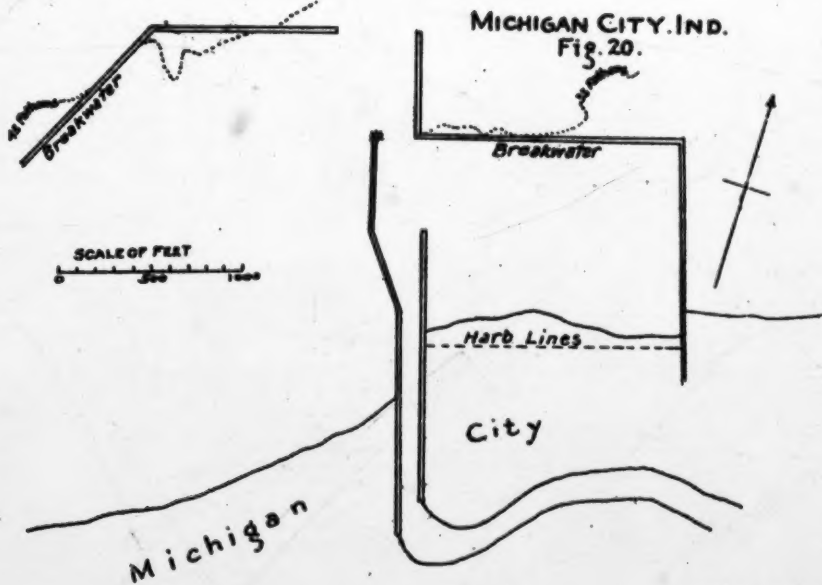


Plate.3.

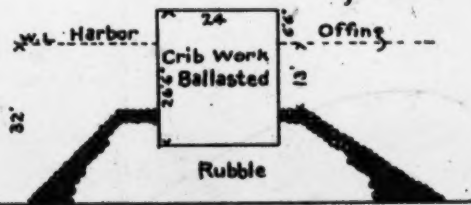
MILWAUKEE BAY.
HARBOR OF REFUGE
Fig. 24.



MICHIGAN CITY, IND.
Fig. 20.



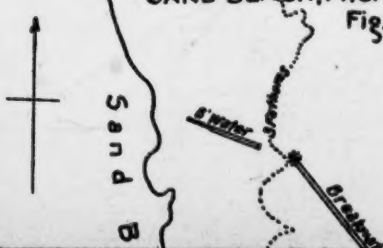
MILWAUKEE BAY
Harbor of Refuge
Fig. 24.a.



DUNKIRK, N.Y.
Fig. 22

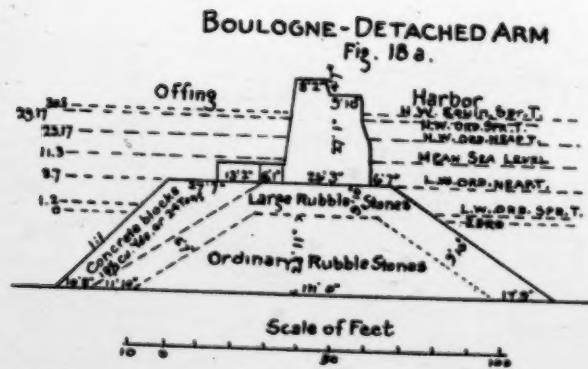
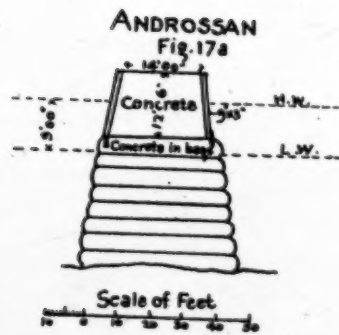
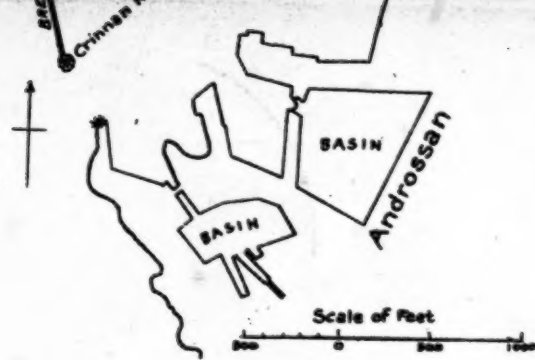


SAND BEACH, MICHIGAN
Fig. 21.

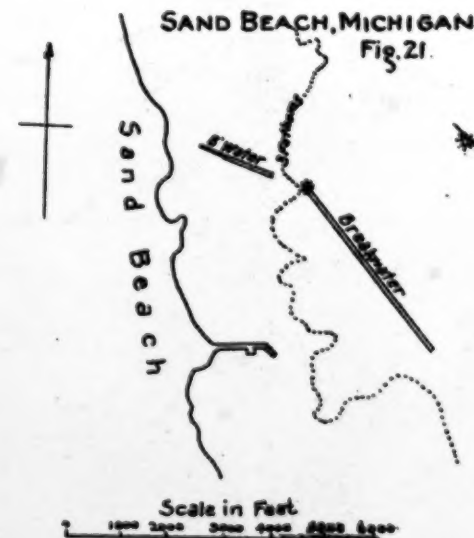
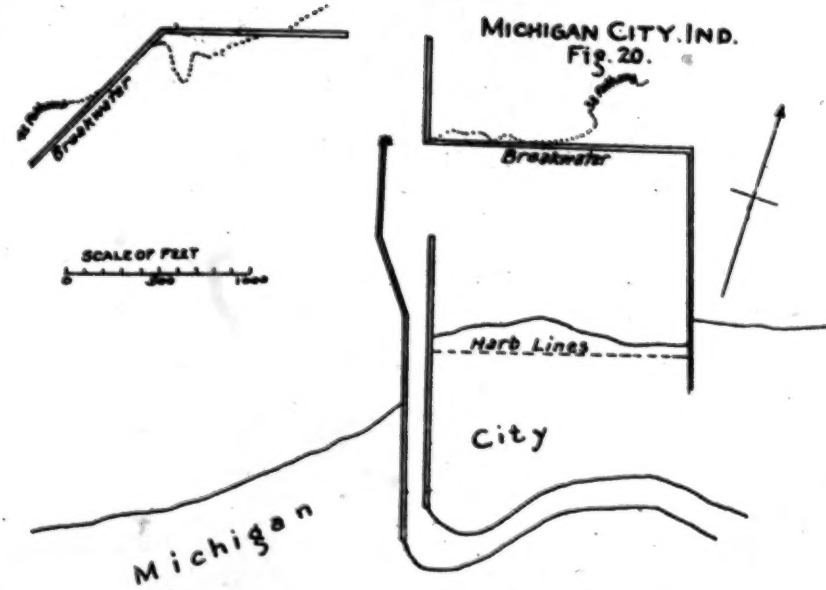
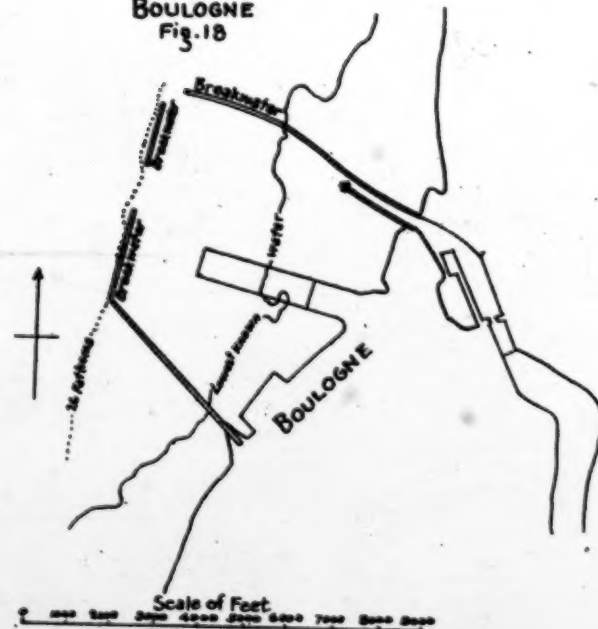


DETACHED BREAKWATERS

Authorities: Figs. 17 and 17a, Proc. Inst. C.E., Vol. CXX.
 18 - 18a. LXX.
 19 - 19a LXXXVII
 20. Report Ch. of Engrs., 1882.
 21 1877.



BOULOGNE
Fig. 18



Scale of Ft.
0 50 100

Slabs and
Ed

Scale of
0 50 100

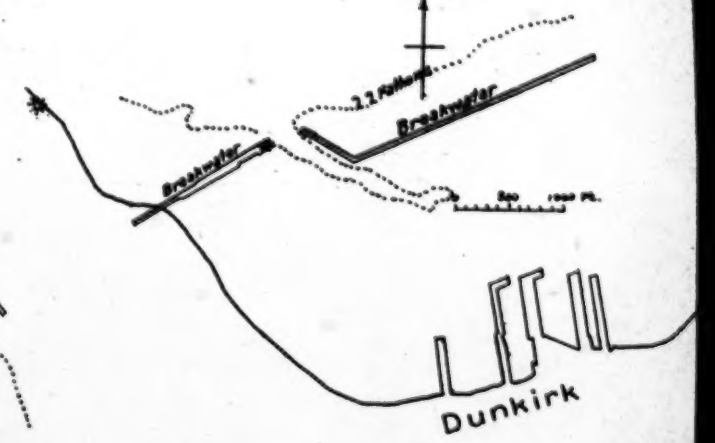
MILWAUKEE

Harbor

Crib

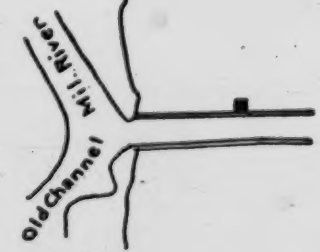
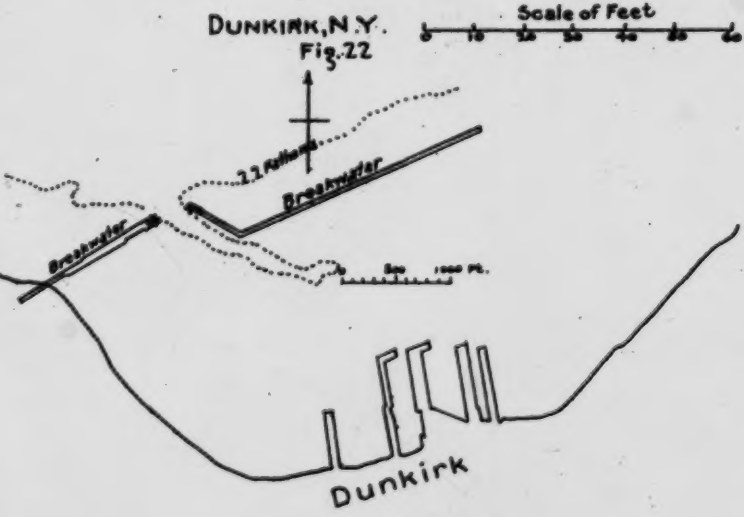
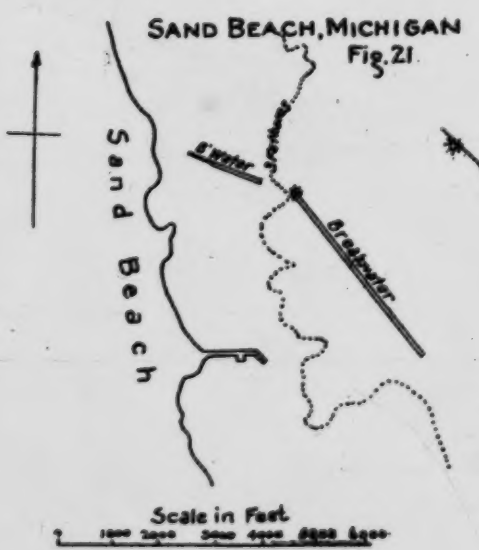
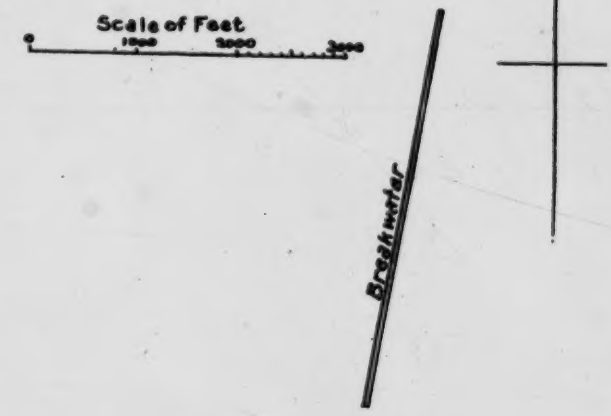
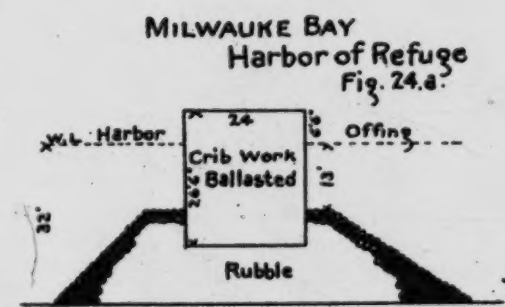
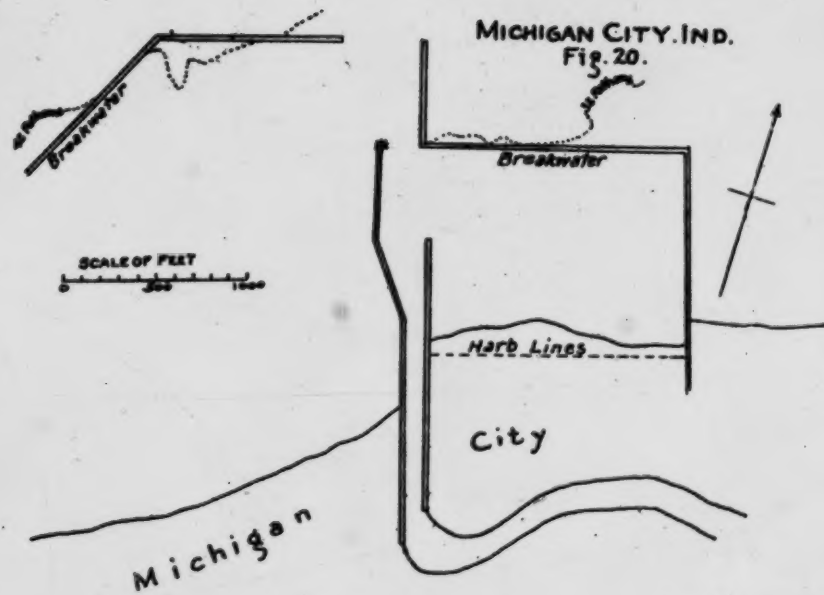
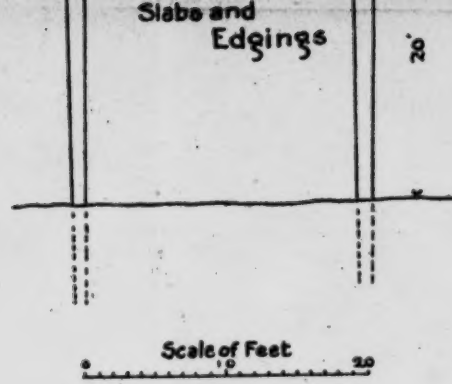
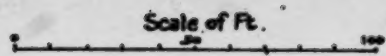
Scale

DUNKIRK, N.Y.
Fig. 22



Dunkirk

Scale in Feet
0 1000 2000 3000 4000 5000 6000

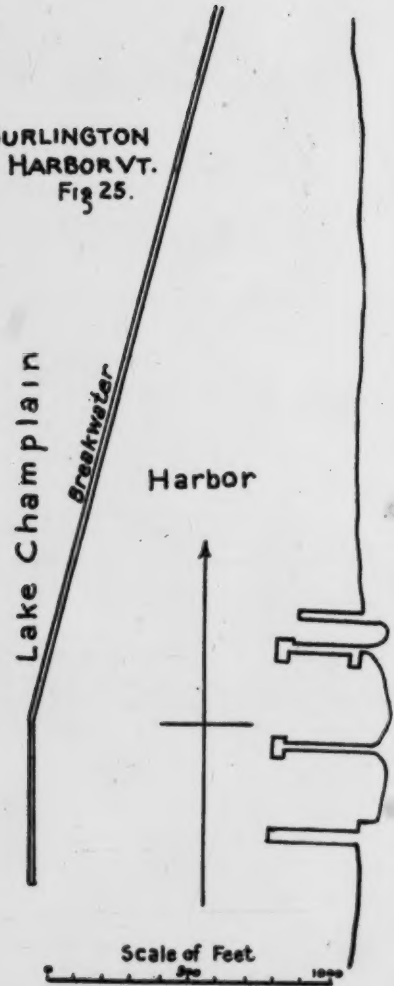


DETACHED BREAKWATERS

Authorities: Figs. 17 and 17a, Proc. Inst. C.E., Vol. CXX.

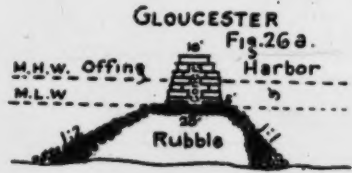
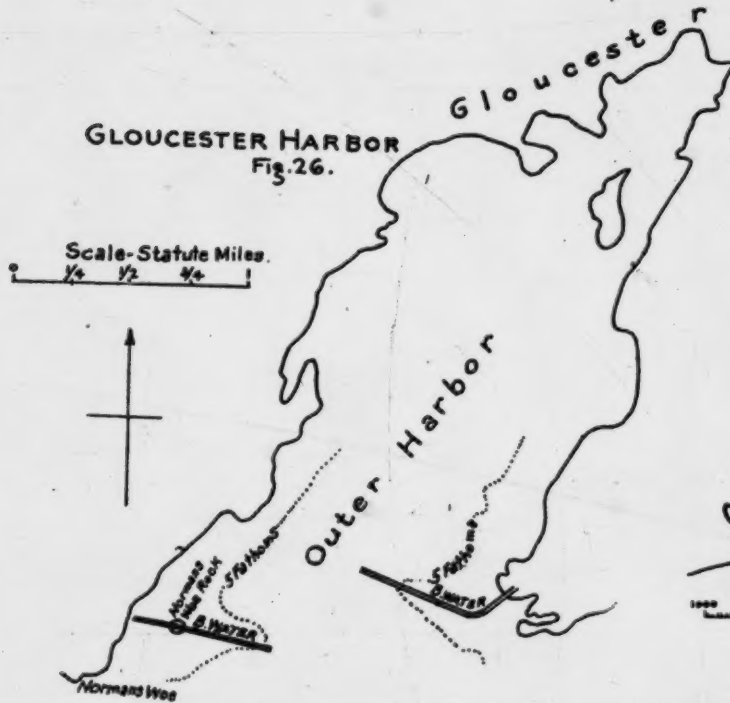
18	18a	.	.	.	.	LXX.
19	19a	.	.	.	.	LXXXVII
20	Report Ch. of Engrs.					1882.
21	.	.	.	.	.	1877.
22	.	.	.	.	.	1884.
23a	.	.	.	.	.	1889.
24, 24a	.	.	.	.	.	1885.

BURLINGTON HARBOR VT. Fig. 25.



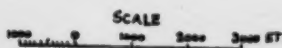
BURLINGTON VERMONT
Last Section of Breakwater

GLOUCESTER HARBOR
Fig. 26.

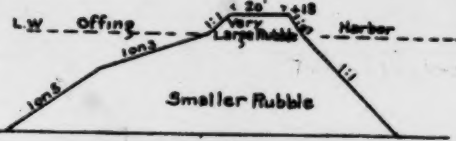


Scale of feet:
0 10 20 30 40 50 60

HYANNIS, MASS.
Fig. 27



SANDY BAY, MASS.
Fig. 28a



Scale of feet:
0 10 20 30 40 50 60 70 80

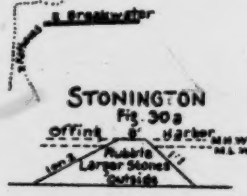
POINT JUDITH, MASS.
Fig. 29



LEWIS BAY



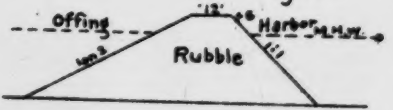
STONINGTON CONN
Fig. 30



STONINGTON
Fig. 30a

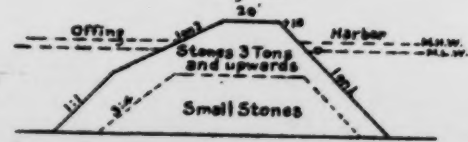
Scale of feet:
0 100 200 300 400 500 600

NEW HAVEN, CONN
Fig. 31a

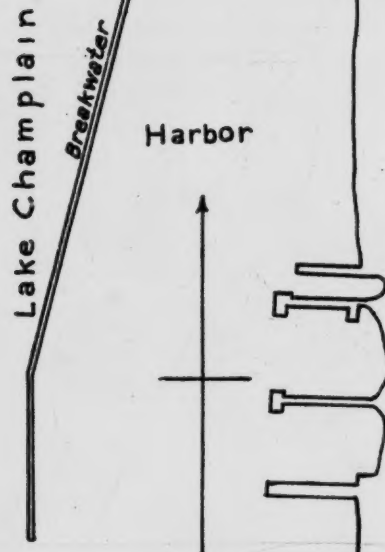


Scale of feet:
0 10 20 30 40 50 60 70 80

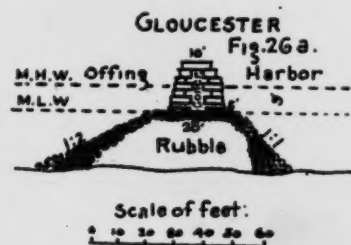
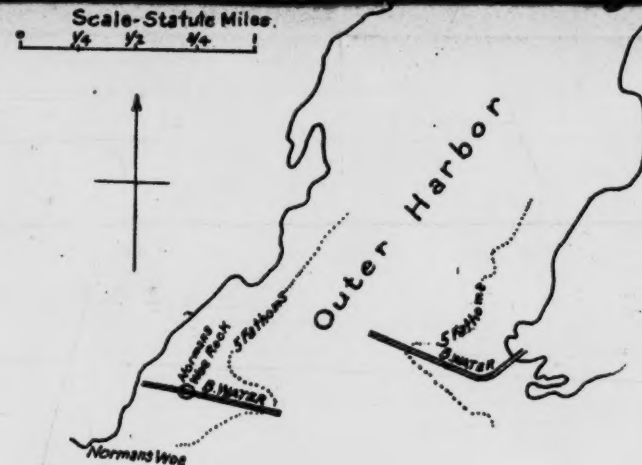
POINT JUDITH
Fig. 29a.



BURLINGTON
HARBOR VT.
Fig. 25.



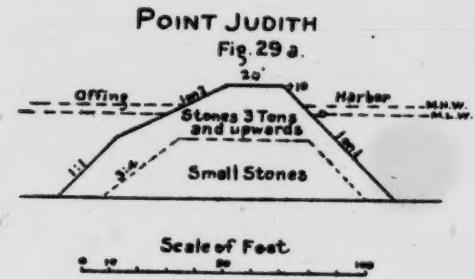
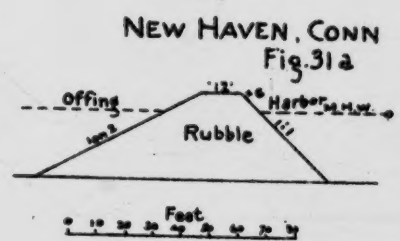
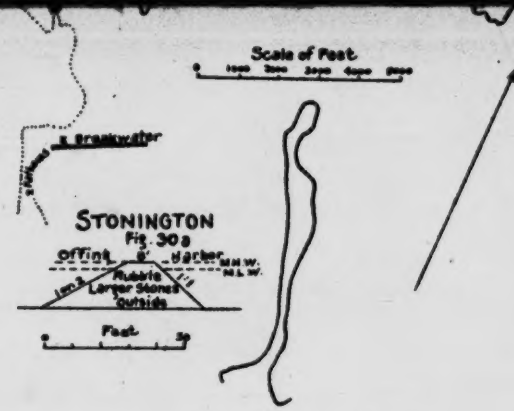
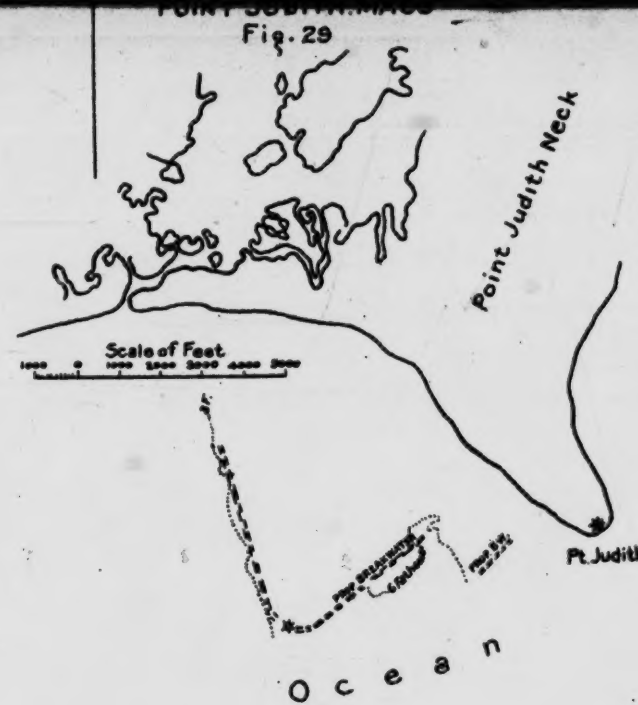
Burlington



HYANNIS, MASS.
Fig. 27

SCALE
1000 2000 3000 FT.

Fig. 29



DETACHED BREAKWATERS

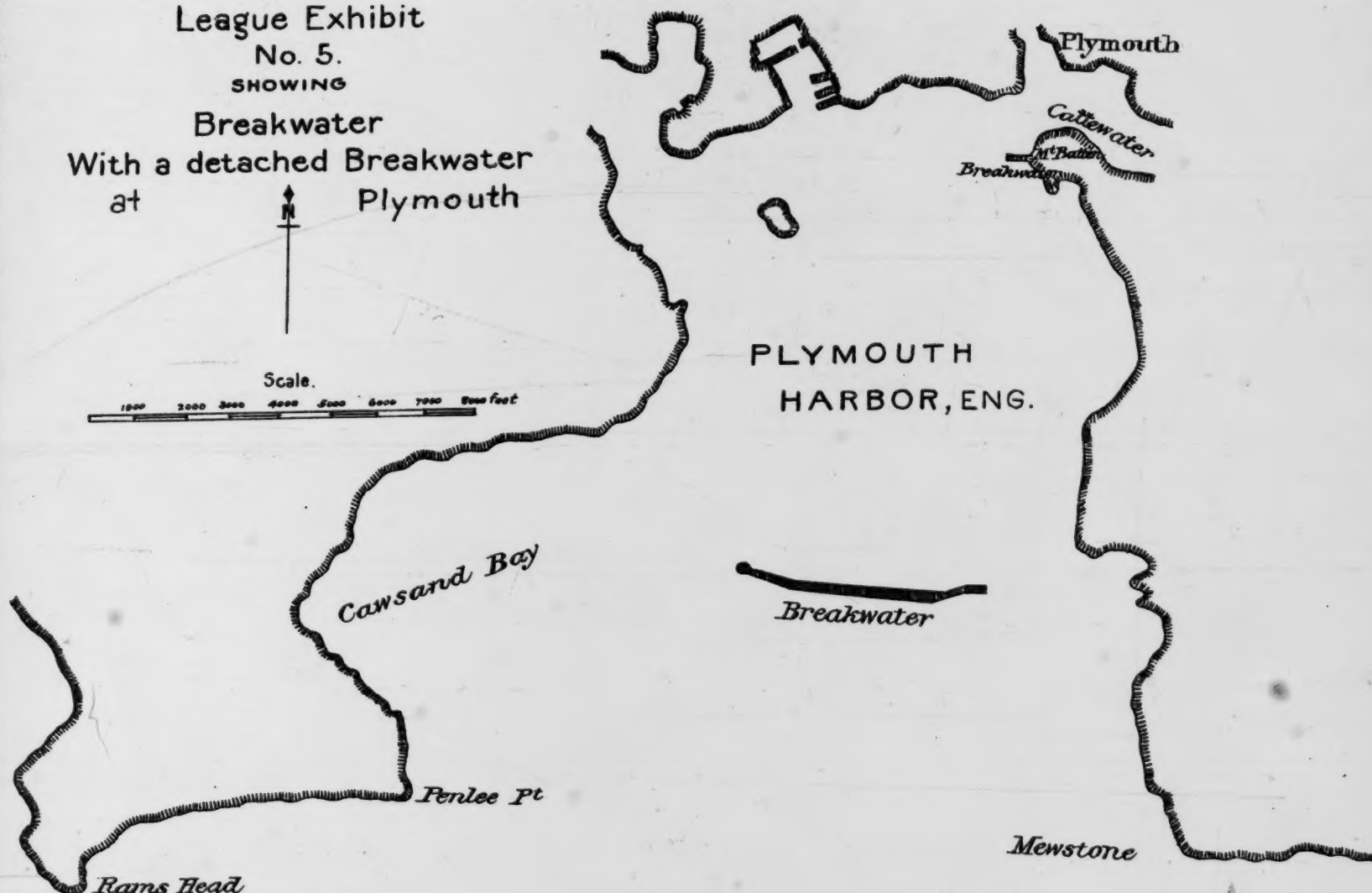
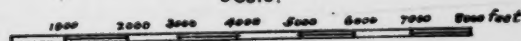
Id. Authorities: Report Ch of Engrs. 1866. Fig. 25.

"	"	"	1893	"	25 a
"	"	"	1887	"	26 and 26a
"	"	"	1893	"	27, 28a, 29 and 29a and 30
"	"	"	1895	"	30 a and 31a

League Exhibit
No. 5.
SHOWING
Breakwater
With a detached Breakwater
at Plymouth



Scale.



THE HOBBS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

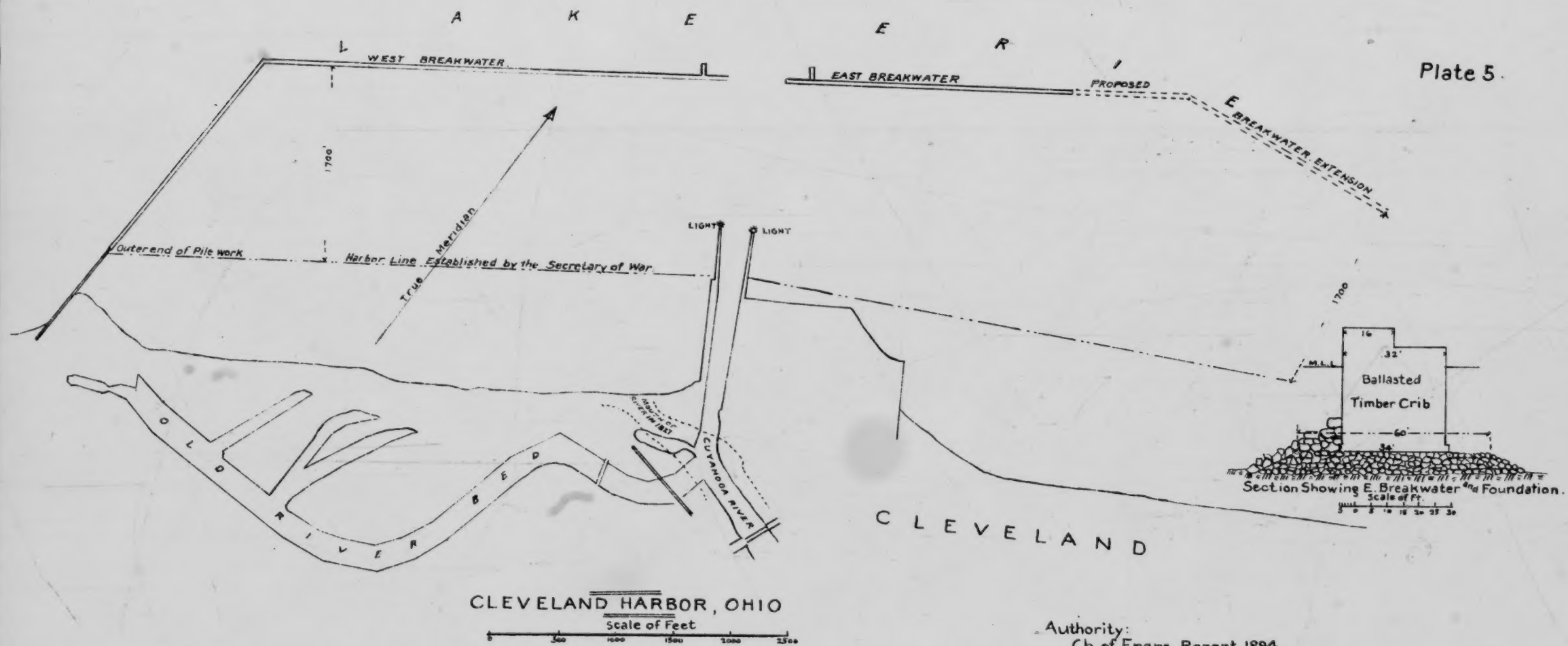


Plate 5.

Authority:
Ch. of Engrs. Report, 1894.

CLEVELAND, OHIO.

[Authority: Annual Report Ch. of Engrs., 1894.]

See pl. 5.

Cleveland Harbor is entirely exposed to winds from the northeast, north, and west. The least fetch for a northwesterly gale is 50 miles, and these gales give the most trouble. (Ed.)

The breakwater is in water from 31 to 32 feet deep. It is constructed upon a foundation of riprap stone which is designed to be 6 feet deep after it has settled compactly together. For this reason it is made about 1 foot higher when dumped into place. The width of the riprap foundation is 60 feet on top, with slopes of 1 on 2. The middle line of foundation coincides with the middle of the breakwater.

The cribs of the breakwater are 32 feet wide, and an arrangement is given to the bottom pieces by which the base has a width of 34 feet. The bottom is extremely soft.

The superstructure of all the east breakwater has been constructed with a parapet on the lake side twelve courses of timber (approximately about 12 feet) above mean lake level. The half on the harbor side has been built only six courses high.

Tide table to accompany Notes on Detached Breakwaters.

[Compiled from Coast and Geodetic Survey tables for 1896.]

Page.	Locality.	Range of tide.			
		Mean.	Spring.	Neap.	Great Tropic.
1	Cherbourg.....	14.2	17.8	10.1	13.8
2	Alexandria.....	0.8	1.1	0.3	0.8
3	Leghorn.....				
4	Marseilles.....	0.5	0.6	0.3	0.7
5	Triest.....	1.4	2.0	0.5	1.4
6	Plymouth.....	9.4	15.3	2.4	10.0
7	St. Jean de Luz.....	9.3	12.7	5.2	8.3
8	Socoa.....	8.8	12.0	4.9	7.8
9	Brest.....	14.7	19.9	8.6	14.0
10	Civita Vecchia.....				
11	Portland, England.....	4.2	6.7	1.0	4.5
12	Delaware Breakwater.....	4.4	5.3	3.7	4.8
13	Androssan.....	7.4	8.8	5.8	
14	Boulogne.....	19.4	25.2	12.8	19.0
15	Colombo, Ceylon.....	1.4	2.0	0.4	1.5
16	Gloucester.....	8.9	10.2	7.4	10.0
17	Hyannis.....	3.1	3.8	2.2	3.4
18	Sandy Bay (Rockport).....	8.6	9.9	7.2	9.7
19	Point Judith.....	3.1	3.7	2.4	3.4
20	Stonington.....	2.7	3.2	2.1	3.1
21	New Haven.....	6.0	7.2	4.7	6.5

SANTA MONICA, CAL., December 10, 1896.

I hereby certify that this photograph, taken from negative No. 2611, showing Santa Monica Bay and landing of the steamer *Santa Rosa*, was taken at 10 o'clock a. m. on the 25th day of November, 1896.

H. F. RILE, Photographer.

SANTA MONICA, CAL., December 10, 1896.

Sworn and subscribed to before me, Robert F. Jones, a notary public, this 10th day of December, 1896.

[SEAL.]

ROBERT F. JONES.

Notary Public in and for Los Angeles County, Cal.

STATE OF CALIFORNIA, County of Los Angeles, ss:

F. E. Dornfeld, being duly sworn, deposes and says: That he is a master mariner and has been engaged in seafaring in all parts of the world for thirty-two years continuously last past, and has during those years served in all capacities in the merchant service; that he has been on the Pacific Coast for twenty-four years, and in the vicinity of the coast of Los Angeles County for twelve years; that at

the present time he is Government pilot for the harbor of Santa Monica, and that he has brought ships to the wharf and docked and moored ships and steamers thereto at Port Los Angeles since it was first opened for business: that on account of his great experience in handling vessels at all times and in all weathers along this coast, more particularly at ports of San Pedro, Redondo, and Port Los Angeles (he having been master of steamers landing at these ports for several years previous to being appointed pilot for the harbor of Santa Monica), he holds himself to be a competent judge of what is considered a suitable condition of sea and weather for making safe landings at any of the above-mentioned ports.

Deponent further declares that on the 25th day of November, 1896, he was at Port Los Angeles continuously during the day attending to his usual duties as pilot of the harbor of Santa Monica and observing the sea and weather, and that there was no time during said day when any ship or steamer could not have moored, docked, discharged, or loaded cargo with perfect safety and dispatch, although a fresh westerly gale was blowing out in the channel, accompanied by a very heavy sea, which could be observed from shore, and which has been confirmed by the reports of the steamers *Santa Rosa* and *Mineola*, which arrived at Port Los Angeles during the morning of said November 25, 1896.

Deponent further says that the steamer *Santa Rosa* arrived at Port Los Angeles at 9 o'clock a. m. of said day, and sailed at 2.45 o'clock p. m., her usual leaving time, and that there was no difficulty or detention of any kind experienced in making her customary landing, handling her freight and passengers, and leaving on schedule time; that in this respect it is not true, as reported in the Los Angeles Times of November 26, 1896 (which report is hereto attached), that difficulty was experienced or damage done by reason of the wind or weather.

Deponent further says that the steamer *Mineola* arrived at Port Los Angeles at 10.30 o'clock a. m. of said November 25, 1896, from British Columbia, with a cargo of 3,200 tons of coal, and that she was immediately docked and commenced discharging into the bunkers without the slightest difficulty or delay.

F. E. DORNFELD.

Subscribed and sworn to before me this 1st day of December, 1896.

[SEAL.]

RICHARD R. TANNER,

Notary Public in and for Los Angeles County, Cal.

SANTA MONICA—DIFFICULTIES IN LANDING EXPERIENCED BY THE SANTA ROSA.

SANTA MONICA, November 25.—(Regular correspondence.) The storms which have of late been playing havoc along the northern coast seem to have extended to southern California. During Tuesday's heavy rain it was observed that the waves were running unusually high at Santa Monica. Yesterday morning the rain had ceased and the sun shone brightly, but the sea seemed to be affected by some great disturbance far out from land. The waves broke furiously along the shore. The steamer *Santa Rosa*, on her northern trip to San Francisco, was to have landed at Redondo about 6 a. m. yesterday. She steamed up within half a mile of the wharf and then gave up the attempt. Some of the vessel's officers say the waves were breaking over the wharf at the time. The steamer could doubtless have moored to the wharf had it not been for the risk in getting lines made fast. This is due to the peculiar formation of the beach at that place. The passenger wharf is only about 300 feet long from high-water mark on shore to its outer end, but even with that short length there is a depth of about 60 feet of water at the outer end, while at Port Los Angeles at the outer end of the wharf, 4,700 feet in length, there is a depth of only about 40 feet of water at high tide.

If the *Santa Rosa* had been sure of getting moored to the wharf at Redondo, there would have been comparatively no danger. Had there been an error in heaving lines and making fast as the steamer got even with the wharf, it would probably have been impossible to prevent her from going onto the beach such a short distance away.

After getting within a half mile from the wharf at Redondo, the *Santa Rosa* turned about, and keeping well off shore, made for Port Los Angeles. At that place there was somewhat more than the usual difficulty in making lines fast. There was probably no less risk of missing a mooring when the vessel got even with the wharf than there was at Redondo, but if such an error were committed the steamer had sea room enough so she could have turned and put out to sea before being carried onto the beach.

The *Santa Rosa* stayed at Port Los Angeles till her usual time for sailing northward in the afternoon. She ground and chafed against the fender battens in a way that made the big wharf tremble, but, as far as reported, no serious damage

was done. Captain Alexander did not go to his room, as captains usually do after a steamer is made fast at port, but stayed on deck all the morning, ready to act should there be any emergency.

As the day wore on, the heavy seas moderated, but during the afternoon incoming waves were seen to be crested with foam when miles out from shore.

The steam collier *Mineola*, Captain Pillsbury, arrived yesterday at Port Los Angeles with a cargo of coal for the Southern Pacific Company. She left Comax, British Columbia, at midnight last Thursday night. When off Cape Flattery, she experienced a heavy snow fall, which is something very unusual in that neighborhood so early in the season. Sleet fell and froze on exposed places, and snow to a depth of about 6 inches fell on deck. The vessel encountered a storm from the east during Friday and Saturday. On Sunday she had fair weather. When off San Francisco Monday night, there came another storm, a gale blowing from the south, and after this had abated, there came another gale from the north.

The *Mineola* was only about twenty-four hours behind the ill-fated collier *San Benito*, which was wrecked a short distance north of Point Arena light-house. The *Mineola* passed Point Arena at noon Monday. There was a thick mist at the time, but the light-house was visible for a few minutes. The coal brought by the *Mineola* weighs 3,050 tons, which is about 300 tons less than she carried during the summer, when there is less danger from storm. After discharging her cargo, she will probably return to Comax.

[Los Angeles Daily Times, November 26, 1896.]

The experience of the *Santa Rosa* in making a landing at Santa Monica in moderately bad weather, after failing to land at Redondo, seems to indicate that Santa Monica is not much of a port in a storm.

SAN FRANCISCO, December 11, 1896.

DEAR SIR: Herewith find a copy of a letter addressed to me by Mr. A. F. Pillsbury, master of the steamship *Mineola*, dated November 28, relative to docking facilities at Port Los Angeles, which is sent for your information.

Yours, truly,

R. P. SCHWERIN, Manager P. & S.

WM. HOOD, Esq., Chief Engineer of Building.

PORT LOS ANGELES, November 28, 1896.

DEAR SIR: Permit me to call to your attention the circumstances of our docking at Port Los Angeles, on our arrival here on the 25th instant, which will confirm what I have already said in favor of this port, viz, that in heavy weather the sea does not reach into the wharf.

On the night of the 24th and 25th and morning of the 25th instant, coming through the Santa Barbara Channel, the wind was blowing a gale from the westward and a heavy sea running—large seas coming on board and flooding the decks. On approaching the wharf, at 11 a. m., the sea gradually subsided, although the wind blew strong all day. No difficulty was experienced in making a landing. Discharging of cargo was commenced immediately and carried on as usual, without interruption.

The steamer *Santa Rosa* was lying at the wharf, having come by Redondo that morning without making a landing—the sea being too heavy—and later in the day 150 feet of the outer end of the Redondo Wharf was carried away by the heavy sea, and at other points along the southern coast report came of heavy seas and damage to property.

Respectfully,

A. F. PILLSBURY,
Master Steamship *Mineola*.

R. P. SCHWERIN, Esq.,

Manager P. J. Co.'s Steamers, San Francisco.

PORT LOS ANGELES, CAL., January 2, 1897.

DEAR SIR: Referring to attached clipping from the Times of December 30, relative to difficulty of the mooring of the *Guy C. Goss* on December 29, I hand you

herewith a photograph taken by Mr. Rile, showing the ship being made fast to the wharf. Of course you are aware that the clipping from the Times is nothing but nonsense, but at the same time the photograph is proof that the statement is altogether untrue.

Yours, truly,

A. M. JAMISON, Agent.

Mr. J. A. MUIR,

Superintendent Southern Pacific Company, Los Angeles, Cal.

[Los Angeles Daily Times, December 30, 1896.]

SANTA MONICA—A VESSEL SKILLFULLY MOORED IN THE BIG BILLOWS.

SANTA MONICA, December 29.—(Regular correspondence.) The heavier swells on the sea, which the harbor Board was seeking Monday, did not arrive till to-day. It usually takes a day or so to develop the large swells, and this appears to have been a fact in this case. The swells observed to-day were somewhat exceeded in size by those of some of the storms last year, but they were the largest that have been noted this winter. There has, however, been no storm of consequence as yet this season. The bark *Guy C. Goss*, which has been lying at anchor for several days, was moored at Port Los Angeles to-day preparatory to discharging. The operation of mooring involves a more or less elaborate process, and usually attracts a considerable crowd of lookers on. With the unusually heavy swells that were rolling to-day the mooring was of more than ordinary interest.

When placed in position for discharging at Port Los Angeles, a vessel is not tied against the wharf, or so that it touches the wharf. It is moored so that it can not approach nearer than about 10 feet from the wharf. The cargo is taken off by donkey engine.

After the bark had been moved within about 200 feet of the wharf this morning, three lines each from bow and stern were attached to the wharf; the former far ahead of the vessel and the latter a long distance aft. Had there been any lubberly work in passing the lines there would probably have been trouble, but the wharfmen employed for that purpose can carry lines in almost any kind of a sea. There were four of them in a strong rowboat, propelled with great sweeps, that bent as if they would break. The skillful manner in which they handled the boat over the great swells commanded admiration. They would rush under the bow of the bark, and just as it seemed that that part of the vessel was about to press them down into the sea, they would be out on the other side. They would get so close to the vessel that it seemed as if the billows would surely crush their craft against it, but somehow they managed to keep their distance.

Tying the big hawsers together while rocked by heavy seas and handicapped by uneven strain on the lines is a difficult thing to do, especially where the lines are so large and clumsy, but they accomplished it with neatness and dispatch. Lines under them threatening with every swell to pull their boat out of the water and dump them into the sea and lines over them threatening to pull them down into the depths appeared to cause them no fear, for they worked coolly and never seemed to make a mistake.

Captain Dornfeld, master of the wharf, watched the proceedings closely so as to guard against the vessel getting to and pounding against the wharf. When the requisite number of lines fore and aft had been connected with the wharf, the lines were tightened and the vessel was gradually drawn to a position a few feet from the structure and made fast there by lines on all sides.

A person watching the billows from the wharf to-day might easily have thought they were 10 feet or more in height. Careful observation, however, showed they were not as high as they appeared. The bow of the *Guy C. Goss* was elevated and depressed from 10 to 12 feet by the heaviest swells. Assuming that the actual height of the swells was half that much, they would be from 5 to 6 feet high.

[The Weekly Signal, December 31, 1896.]

AN UNPREJUDICED WITNESS.

Captain Mallett, of the bark *Guy C. Goss*, now unloading at Port Los Angeles, and entirely disinterested and unprejudiced, was this morning shown the screed contained in the Los Angeles Times relative to the condition of the water at the

long wharf yesterday. He perused it carefully, and his dark eyes snapped as he said, "I would like to see the man who wrote that. Why," said he, "the swell yesterday did not reach 2 feet. More than that, it was not an ocean swell. I came alongside the wharf in the early morning and began discharging from all three hatches of the vessel without the slightest inconvenience or damage either to vessel or wharf. The vessel was alongside all day. No lines were parted. We were within 3 feet of the wharf, as close as we would be to any wharf. I considered it a fine day. If it had not been, I would have postponed discharging and would not have come to the wharf. Further, there were not any more lines than are ordinarily used in making fast any vessel to any wharf outside of still water—no tying or lashing together of big hawsers or anything of that sort."

The Captain said: "Why, it would be exasperating, if not so ridiculous, the statement that the bow of my ship was 'elevated and depressed from 10 to 13 feet.' If such had been the case, the cottages on the beach and the North Beach bath house would have been under water."

This is Captain Mallett's first visit to this port, and he expressed himself as well pleased with this harbor.

The people of this city are very loath to believe that the genial correspondent of the Los Angeles Daily Times, who is a fairly good fellow, and whose veracity as a man would never be called in question, could so far sink his manhood into the character of the average newspaper reporter as to perpetrate upon a patient and long-suffering public such a barefaced fairy tale as the one which is related in the Los Angeles Times concerning the condition of Santa Monica Bay yesterday. It is barely possible that the Times has two correspondents, a San Pedro correspondent who writes from here, and a Santa Monica correspondent as well, and that the fairy tale in question was the product of the San Pedro man's intellect. If so, it is easily understood, for San Pedro advocates are not accustomed to being bothered by such a small thing as the truth.

It is hard, however, to understand how a resident of Santa Monica, daily receiving favors from her citizens, could so indulge his imagination to the damaging of the reputation of this fair city and the fairest bay in southern California.

[Letters from the people.]

NO ANCHOR LEFT—HOW THE SHIP AMERICA WENT ASHORE AT SAN PEDRO.

The EDITOR OF THE SAN FRANCISCO CALL.

SIR: In your issue of to-day I note a statement over the signature of C. F. Swan, master of bark *Theobald*, where he says the ship *America* went on shore at San Pedro with one anchor on the bow and no crew on board. When the gale came on from southeast, knowing the exposed position of the ship, every precaution was taken to hold her to her anchors. The second anchor was let go with a good spread, and not foul, as the captain stated. As the gale increased, the stream and kedge anchors were let go with hawsers attached. In the height of the gale the port chain parted and the ship began to drag. In giving more chain on starboard anchor the compressor lost control of the windlass, and, the chain going out with great force, carried away the 2-inch bolt which fastened it to the keelson. Of course the chain went overboard. When the ship struck the reef, she had not an anchor left. The crew consisted of fifteen men, officers included (her sea complement being twenty-five), a force sufficient to handle the anchors. The writer's experience of twenty-five years as master has taught him better than to jeopardize the ship's insurance and owners' property by such a lubberly trick as letting his ship drive on shore with his anchors on the bow in a port like San Pedro.

J. R. HERRIMAN,
Late Master Ship *America*.

SANTA CLARA, CAL., December 29.

LOS ANGELES, January 9, 1897.

Admiral JOHN G. WALKER,
Chairman Harbor Commission, Los Angeles, Cal.

MY DEAR SIR: Inclosed please find letter from Capt. W. M. Mallett, master of the American bark *Guy C. Goss*, addressed to the editor of the Maritime Register, New York, giving his testimony as to Port Los Angeles anchorage, holding ground, etc.

Very respectfully, yours,

J. A. MUIR.

PORT LOS ANGELES, CAL., January 7, 1897.

The EDITOR OF THE MARITIME REGISTER, *New York*.

DEAR SIR: I have finished discharging a 2,200-ton cargo of general merchandise and taken on board 450 tons of ballast at Port Los Angeles and am now ready for sea. During the three weeks that I have been here there has not been a day that a ship could not lay comfortably at the wharf. The anchorage and holding ground is as good as could be desired. Cargoes are handled with dispatch and very carefully, and I am so well pleased with the place in every way that I would gladly accept a charter for here at any time.

Yours, respectfully,

W. M. MALLET,

Master American Bark Guy C. Goss.

